Marie C. Eichelsen

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from the author.

MEDICAL EDUCATION

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MEDICAL EDUCATION

A Comparative Study

BY

ABRAHAM FLEXNER

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TO

FREDERICK T. GATES

PREFACE

The present volume attempts to make a comparative study of medical education in certain European countries and America against the background afforded by the general educational and social systems of the respective countries. It endeavors to depict and to discuss general tendencies and principles. Under the limitations within which I worked, I could not include all variations and exceptions, though I have, sometimes in the text, sometimes in notes, indicated their extent and importance. The particular individuals and institutions mentioned must be regarded only as illustrations encountered in the course of my reading or experience. While I have tried to be fair, I cannot be sure that I have always chosen the most felicitous examples. I should indeed have avoided all definite references, were it not for the fact that the presentation would then have become both dull and pointless.

On the clinical side, internal medicine is my central theme. Other branches are, of course, important and necessarily differ in educational treatment—surgery and obstetrics, for example. I have, however, not discussed them in equal detail, because I am persuaded that, if a sound organization is perfected, if support can be obtained and the medical clinic is properly carried on, the requisite adjustments in other clinics will more or less readily come about. I have also omitted postgraduate education, not because it is unimportant, but because it represents a different problem; and examinations for licensure, not because they have no influence on teaching—they affect it seriously and on the whole disadvantageously—but because they have undergone no substantial modification since the publication of Bulletins No. IV and VI of the Carnegie Foundation for the Advancement of Teaching, in which they were fully

discussed. Moreover, if the general trend of my presentation is sound, the examinations for licensure will in course of time be readjusted.

I am at a loss as to how to make proper acknowledgments to those who have aided me in the preparation of the book. A layman's account of medical education is obviously only a report of the experience, practice, and reflection of those who are engaged in educating medical students and in carrying on medical research. I am therefore under the heaviest possible obligation to scores of teachers, practitioners, and investigators, educational officials and authorities the world over—men who have explained to me what they are doing, labored to make me understand their problems and viewpoints, furnished me with data and memoranda, and, finally, read and corrected the proof sheets. Enumerate them, I cannot, within the limits of a preface; will they not accept this general expression of my gratitude, as the only recognition that under the circumstances I can make? Meanwhile, let me add that I, more than they, realize its inadequacy. Perhaps, too, I may venture, without being misunderstood, to mention those upon whom I have made the heaviest demands—my brother, Dr. Simon Flexner, my associate, Dr. Richard M. Pearce, Director of the Division of Medical Education of the Rockefeller Foundation, Dr. David L. Edsall, Dean of the Harvard Medical School, Dr. Alfred F. Hess, Clinical Professor of Pediatrics in New York University, Professor Franklin C. McLean of the University of Chicago, Dr. Paul H. Hanus, Emeritus Professor of the History and Art of Teaching of Harvard University, Sir George Newman of the Ministry of Health, London, Professor Heinrich Poll of the University of Hamburg, Professor Israel Holmgren of Stockholm, Drs. Edouard Rist and Jacques Hertz of Paris, Professor Réné Leriche just called from Lyons to be Professor of Surgery at Strasbourg, Professor Knud Faber of Copenhagen, Professor F. deQuervain of Bern, and Professor Storm van Leeuwen of Leiden. But this brief list omits a host of American, Canadian, English, Scotch, French, Dutch, German,

Swiss, Danish, Swedish, and Belgian physicians, teachers and administrators, to whom I am hardly less deeply indebted. I must not, however, omit to say that, though I have derived ideas and information from every available source and have endeavored to avoid mistakes by procuring criticism at every stage, I am myself alone responsible for the position taken in matters of opinion, and for such errors of fact as still remain.

Finally, it is a pleasure to make grateful acknowledgment of the coöperation of my secretary, Mrs. Esther S. Bailey, who has assisted me in arranging and classifying the voluminous data on which the book is based, and whose care and intelligence have very greatly lightened the labor of writing it.

ABRAHAM FLEXNER.

"Ingleside,"
Ahmic Lake, Ontario,
August 1, 1924.

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CHAPTER I

MEDICINE AND MEDICAL EDUCATION

From what point of view are the problems of medical education to be studied and presented? That depends on whether medicine is conceived to be an empiric art, a science, or something struggling towards scientific status. Our opinions of present educational procedure, our suggestions as to educational development will vary greatly, according as we adopt one or another of these three conceptions. The Chinese, taking one view, followed one course of action; the French, taking another, follow a different line of action; the more modern American schools, very differently minded, pursue still another course. Let us therefore begin by briefly considering what manner of thing western medicine is, what manner of thing it is endeavoring to become.

I

From the earliest times, medicine has been a curious blend of superstition, empiricism, and that kind of sagacious observation, which is the stuff out of which ultimately science is made. Of these three strands—superstition, empiricism, and observation—medicine was constituted in the days of the priest-physicians of Egypt and Babylonia; of the same three strands it is still composed. The proportions have, however, varied significantly; an increasingly alert and determined effort, running through the ages, has endeavored to expel superstition, to narrow the range of empiricism, and to enlarge, refine, and sys-

tematize the scope of observation. Superstition is perhaps easily enough recognizable; but the line between an empirical and a scientific observation is not always so clear. That quinine cures malaria, that sunlight cures rickets, that morphine quiets pain, that mercury cures syphilis—these observations, being correct, may as such be termed empirical or scientific at will. A real difference can be made out only at the next step. Empiricism does not endeavor to penetrate more deeply, is not solicitous as to limitations—in others words, gets no further. The very soundness of an observation challenges the scientist; he is not content with a fact; he asks why, and how far. The scientist is therefore at once modest and active—conscious of the narrow limitations of achievement, seeking to establish larger and surer combinations, while the empiricist, practising his rule of thumb, works disjointedly and tends to remain, in reference to any particular practice or observation, just where he is. The general trend of medicine has been away from magic and empiricism and in the direction of rationality and definiteness.

To be sure, from time to time, old superstitions revive or new superstitions spring up; empiricism—sometimes blind, sometimes critical—is driven from one point only to reappear at another, often in connection with a genuine scientific advance. The history of thought is the fluctuating record of deliberate efforts to purge knowledge of both mystical and empirical contamination; but with the best will no one succeeds completely. Something of the mystic, the philosopher, and the empiric clings to every one of us. Men lead inconsistent intellectual lives, and, notwithstanding the clarification of the last seventy-five years, no single mind is yet equally sure and cautious at every step and in every direction. At every stage, even the great men yield, from time to time, to the metaphysical spell, blunder in interpretation, or, in their pride and enthusiasm, try to extort from facts more than they contain. On the whole, however, the tendency to view disease as amenable to scientific study and treatment has, especially in recent years,

been strengthened at the expense of both superstition and empiricism—even intelligent empiricism.

In what sense, then, can modern medicine today be called a science? If the term "science" is to be strictly confined to knowledge capable of quantitative expression and utilization, science would begin and end with mathematical physics—itself perhaps not of the final character supposed in the days before the coming of Einstein; chemistry and physiology would be sciences, in so far as they are reducible to physics and no further. Other disciplines, to which we now attach the name—the social sciences, for example, or agriculture, in which an increasing volume of systematized knowledge and practical art is, as in medicine, indistinguishably blended—would cease to be so called.

Neither on theoretical nor on practical grounds can so narrow a use of the term be successfully defended. We do better, taking an historical view, to consider science as the persistent effort of men to purify, extend, and organize their knowledge of the world in which they live. Undoubtedly the more accurately—or mathematically—the organization of knowledge can proceed, the better; and mathematical form may well be recognized as the goal towards which scientific effort strives. But it is absurd to set up the single mathematical category, which ignores complications of material that may prove forever refractory, or innate limitations of capacity beyond which men cannot go. For practical purposes, at any rate, science must be considered as simply the severest effort capable of being made in the direction of purifying, extending, and organizing knowledge. So long as men strive to transcend their native powers, to rid themselves of prejudice and preconception, to observe phenomena in a dry light, the effort is scientific, whether at the moment it attains mathematical accuracy or not. I say, advisedly, the *effort* is scientific. How much success the effort must achieve, how large a volume of fact must have been accumulated and set in order, how far laws must have been deduced, before one is entitled to speak of a

science rather than of scientific effort—these are questions that admit of no invariable answer. They are, in any event, of theoretic rather than practical importance. For our purposes, science may safely be treated as a developing conception, moving at different rates and with varying degrees of confidence towards the entire comprehension embodied in the mathematical formula. And in this sense we are entitled to assume not only the science of mathematics and the science of physics, but also the science of biology, the science of psychology, the science of society, the science of agriculture, and the science of medicine.

On the ground of the increasingly successful effort to expel superstition, speculation, and uncritical empiricism from medicine, and to base both knowledge and practice on observation, experiment, and induction, the present volume discusses the science of medicine. In using the term in this guarded sense no distinction can be made between research and practice. The investigator, obviously, observes, experiments, and judges; so do the physician and surgeon who practise their art in the modern spirit. At bottom the intellectual attitude and processes of the two are—or should be—identical: neither investigator nor practitioner should be blinded by prejudice or jump at conclusions; both should observe, reflect, conclude, try, and, watching results, continuously reapply the same method until the problem in hand has been solved or abandoned. To what extent scientific results have already been obtained, to what extent the spirit and methods of science already prevail in practice—these are questions that are for the moment beside the mark. At one point, practice lags behind theory; at another, theory has not yet overtaken practice. There is no pretense that science has as yet subdued either practice or education. For the present, however, we are concerned only with establishing a point of view, from which, with whatever allowances, tendencies may be interpreted, the present estimated, and future educational policy directed. The spirit and method of the endeavor, rather than the measure of success won in a brief period, are, for education, the significant criteria.

To the foregoing discussion, objection might be made on the ground that, after all, the question is one of definition without practical importance. Without doubt, it is a question of definition, whether medicine be or be not classified as a science. But definition in this instance is far from being devoid of practical significance. If medicine is classified as an art, in contradistinction to a science, the practitioner is encouraged to proceed with a clear conscience on superficial or empirical lines; if, on the other hand, he is acutely conscious of a responsibility to scientific spirit and scientific method, he will almost inevitably endeavor to clarify his conceptions and to proceed more systematically in the accumulation of data, the framing of hypotheses, and the checking up of results.

II

There is a widespread impression that the scientific quality of medical education and medical practice is in some fashion dependent upon the part played by the laboratory. This is not the case. Science is essentially a matter of observation, inference, verification, generalization. The mind of Sydenham, interested in a sick child and humanely preoccupied with its cure, did not, in so far as it functioned scientifically, operate differently from that of Galileo, interested in cosmic physics. Both alike observed, reflected, verified, generalized.

Not only is the part played by the active senses the essential criterion of science; one may go further—the vast and complicated experimental paraphernalia of science are merely means of extending their scope. Examination of the patient by means of the stethoscope and the clinical thermometer is but a slight, though enormously important, refinement of observation through the unaided senses. Other more accurate and more powerful devices—the compound microscope, the electrocardiograph, the X-ray plate, the fluoroscope—facilitate observation, but do not modify its essential character. They enable the physician to sharpen his natural powers by exaggerating

the data, be they sounds or sights, or to translate one sense into another, thus escaping from the less competent senses—touch, weight, and hearing—to the more delicate sense of vision, or, better still, to diminish the danger of error by employing several senses in succession. Latterly, observation of the patient has been assisted by animal experimentation; it has become increasingly possible to analyze and to handle complex situations by dealing experimentally with their real or supposed factors. Thus, while clinical indications disclose the general type of disease—meningitis, dysentery, or pneumonia—only laboratory methods can make the differentiation which may suggest the effective therapeutic procedure to be pursued. Yet, strictly taken, the experiment is only controlled, accelerated, and multiplied observation—more fertile, because it takes place under conditions that can be more carefully regulated, repeated, and statistically tabulated. But no new senses or powers have been created; certain possibilities of error have been lessened; others have been introduced. Whatever the aids employed, the physician is still observing, describing, inferring, verifying. He is still, like his less resourceful forbears, scientific only to the extent that he is cautious and guarded.

If this position is sound, the ward and the laboratory are logically, from the standpoints of investigation, treatment, and education, inextricably intertwined. The question of precedence is quite futile. The individual patient is, in the first instance, carefully interrogated and observed; when the unaided senses have reached their limits, he is examined—that is, observed by means of stethoscope and thermometer; subsequently for reasons of convenience, examination may be carried still further in the adjacent laboratory by means of microscope and test tube; in the last resort, animal experimentation may be resorted to, in order to enable the physician to refine observation still further. It is senseless to raise questions as to whether relevant data are obtained in one way or in another. The scientific inquirer assembles facts from every available source and by every possible means. Science resides in the

intellect, not in the instrument. To call a careful and correct bedside observation clinical and a laboratory examination scientific, as if there were some qualitative distinction between the two, is absurd. Whether the observer be seated at the bedside or bending over his microscope, he observes, elicits data, frames an hypothesis, and tentatively pursues the course of action suggested by reflection upon all the facts in his possession, regardless of where or how obtained. The term "scientific" cannot be denied to an accurate observation at the bedside, if it is conceded to a similarly accurate observation made by means of the microscope; nor can it be denied to a correct description of a process observed in a patient, while conceded to the correct description of a process observed in a rabbit or guinea pig. The clinic is scientific, not merely in so far as it utilizes chemical or physical methods and technique, but primarily because it represents a determined, fearless, and painstaking effort to observe, to explore, to interpret, to unravel. It is not saved to science by laboratory methods; it includes them as simply additional weapons with which to do better what scientific clinicians have always done, viz., observe, explore, unravel.

III

Thus medicine, moving as rapidly as may be towards scientific status, recognizes no difference in intellectual attitude between laboratory and clinic. Neither can—nor should—any distinction in intellectual attitude be drawn between investigator and practitioner. For centuries, the question was not even raised. From Hippocrates down, those who contributed their successive bits of precious knowledge to the growing structure were practitioners, using their keen wits at the bedside. The more systematic and self-conscious promoters of scientific medicine in modern times did not for a moment suppose that the spirit of scientific inquiry belonged to them as investigators, while, as physicians or teachers, a merely practical, empirical or technological method was appropriate. "Our patients,"

writes Naunyn, reviewing the early days of scientific medicine in Germany, "obeyed us gladly. Our zeal led them to respect and trust us. It never occurred to them to inquire whether this zeal was in the interest of treatment or in the interest of science." [1]

The practitioner of medicine therefore uses—or should use—the same type of intelligence that is used in the solution of a problem. It makes not the slightest difference whether the problem is entirely new, or merely new to him. In a very real sense, indeed, every case is unique, so that there never comes a time when the watchful intelligence, observing and interpreting, absolutely necessary in investigation, becomes superfluous or irrelevant in practice. The mental attitude of the investigator seeking to disentangle an unsolved problem does not in essence differ from that of the physician who has been summoned to see a patient. Though the experienced practitioner may, by a process of apparently instinctive "short-circuiting," achieve a diagnosis so swiftly that he seems to be guided by something called "clinical instinct," we may be quite sure that, as a matter of fact, the processes actually involved are observation, elimination of the irrelevant, inference—in other words, induction—even though the pace has been so rapid that the several steps are indistinguishable. On the basis of a large experience, he simply selects more discriminatingly and decides more quickly; what looks like a flash of insight may perhaps be less sudden and miraculous than appears; and in so far as it is really a flash, it may be even for him, as it is extremely likely to be for the beginner, a dangerous mistake to suppose that there is any substitute for thorough examination and guarded inference. Nor is the situation essentially changed, because practical or prudential considerations at times require the physician to "do something," while the laboratory investigator is privileged to

[1] *Deutsches Archiv für klinische Medizin,* 140 Bd., 1 u. 2 H., p. 27. The "early days" to which Naunyn refers mean approximately 1860, when he began his seven-year assistantship to Frerichs, who was called from Göttingen to Berlin in 1859.

stop or to go on thinking. Waiting on normal function to re-establish itself, or enlisting psychic factors through deliberate make-believe, is but a confession of ignorance. The physician makes his confession of helplessness in the sick room in one way; the investigator in his laboratory makes his confession in another. Their fundamental attitudes would be different only if the physician, employing a placebo, should come to think he is using magic.

IV

The similarity that unites investigator and practitioner goes, however, far beyond the mental processes involved. It includes increasingly the technique employed—whether clinical or laboratory. To an extent that could not have been safely predicted a decade ago, the practitioner is barking at the heels of the investigator. Less than half a century ago the office of an able urban practitioner consisted of two rooms, one for waiting and the other for consultation. There was little to indicate which was which beyond the ancient tilting haircloth examining chair, the wash-basin never empty, with its pitcher never clean, the roller towel renewed at long intervals, a few simple instruments which, used for all sorts of purposes, were never boiled, two or three vials containing mercury or carbolic acid for local applications, and the mantelpiece strewn with proprietary preparations in dust-covered bottles. Urinalysis was employed—practically no other laboratory procedure. The doctor made up his mind on the basis of symptoms and obvious physical indications. Long experience and natural shrewdness sharpened by necessity carried the best of the old family physicians far. But the common neglect of hygienic precautions must have wrought untold damage, while inability to penetrate beneath the surface constantly forced the practitioner to guess or fumble.

The medical practitioner, trained under modern conditions, obtains and files a careful history of his patient—personal and

family—making and recording a thorough physical examination. He can in his office make a fluoroscopic examination of the chest, a blood count, a Wassermann test, a complete urinalysis; he can examine sputum, gastric contents, and spinal fluid; he can carry on bacterial studies, blood cultures, Widal tests, do blood chemistry, renal function tests, and estimate the basal metabolic rate. He can determine the presence of gastric or duodenal ulcers, of malignant disease, the location of kidney, bladder, or gall stones, etc. Overnight the ordinary treatment of syphilis and diabetes has been revolutionized. With incredible swiftness, delicate and effective apparatus of the most varied kind has repeated the history of the microscope, becoming part of the working armamentarium of the practitioner. The physician in his office daily commands resources that were beyond the reach of the most advanced theoretic investigator a dozen years ago.[2] Unquestionably errors of judgment occur; mechanism may be unnecessarily employed, or too implicitly trusted. A sense of proportion must be developed. Wherever such adjustments are needed, excess, one way or the other, is inevitable. Regardless, however, of these difficulties, which time and experience will tend to set right, it is clear that neither in the nature of the thinking processes, which they employ, nor in the scientific technique, which they utilize, can a sharp line be drawn between practice and research in medicine.

It is, to be sure, true that of the patients who come into the physician's hands a considerable number can be disposed of by clinical methods; a further section suffer from functional disturbances, which yield to time, sympathy, and suggestion. Perhaps only a minority require the more complicated methods of diagnosis and treatment. But the physician must command all three—for otherwise he lacks, first, the means of differentiation,

[2] This description is literally true of many recent American graduates in medicine. State laboratories of public health and, to some extent, reliable commercial laboratories, perform for many well trained physicians similar services, when the physicians are unable to provide it for themselves. Abroad, partly because of economic difficulties, partly because of conservatism, practice has undergone less improvement in this respect.

and, second, he may lack the appropriate means of attack. As time goes on, the unsolved problems will, one by one, be cleared up. More intelligent methods of diagnosis and treatment will be evolved. The realm of empiricism and guesswork will be still further narrowed—now by more discriminating clinical procedure, now by more effective laboratory devices.

I have indicated briefly the manner in which investigative and practical attitude and activities overlap. The conflict between them, of which we are often made aware, illogical as it is, is not a new phenomenon. It has been in evidence at every stage of medical development. Percussion was fought even by the pupils of Auenbrugger and Corvisart, because, neglecting the proper precautions, they were confused rather than helped by the new methods. So when Laennec studied the human chest by means of the stethoscope, the reactionaries of his time—barely a century ago—maintained that the contrivance was not susceptible of use in practice. The same outcry has progressively greeted the clinical thermometer, anesthesia, and the germ theory. Little wonder that it should be again provoked by blood chemistry and radium. If the history of medicine has any bearing on the conduct of medical education, the soundness of a procedure rather than its present difficulty must be the important consideration. The novelty of today somehow becomes the commonplace of tomorrow. Reluctance or incapacity on the part of the older generation, even temporarily excessive difficulty or expense cannot be permitted to halt the process of reorganizing knowledge, education, and practice; and neither knowledge nor practice can be reorganized, except in so far as the conquests of those on the firing line of science are intelligently incorporated in the education of the new recruit.

In respect to the position I have thus far taken, a curious misapprehension not uncommonly arises. The careful scrutiny, reflection, and decision (which is the essence of scientific method), the employment of every weapon by means of which the causation of disease may be ferreted out and health re-

stored (which is the essence of scientific procedure)—these are sometimes regarded as in conflict with the humanity which should characterize the physician in the presence of suffering. Assuredly, humanity and empiricism are not identical; with equal assurance, one may assert that humanity and science are not contradictory. In the long run, precisely the opposite is the case! For men are as apt to devote themselves to medical research and medical practice, because their hearts are torn, as because their curiosity has been piqued; and teachers, however intent on training students in the logic of practice, need not forget to inculcate, both by precept and example, the importance of tact and fine feeling. The art of noble behavior is thus not inconsistent with the practice of scientific method. In any event, though men and nations vary in human sympathy and in the forms in which sympathy finds expression, the variations stand in no necessary relation to either individual or national intelligence.

Again, the assertion that the intellectual attitude of investigator and practitioner should be identical does not mean that practically investigation and treatment coincide; it does not mean that practitioners should all be experimenters or that investigators must all be practitioners. A delicate question arises indeed as to when the results of investigation are to be introduced into general practice. For obvious reasons a stubbornly sceptical attitude is sound, and in general obtains. The practitioner waited long before Ehrlich could convince himself that salvarsan should be put into his hands.[3] But the existence of such perplexities does not result in arraying medical men into two camps—the thinkers, whose main business it is to forge ahead, and the practitioners, who cheer the sick, mitigate their sufferings and apply classical remedies. It is equally important and equally possible for physicians of all types to be humane, and at the same time to employ the severest intellectual effort that they are severally capable of putting forth.

[3] See Marquardt: *Paul Ehrlich als Mensch und Arbeiter* (Berlin u. Leipzig, 1924) pp. 85 ff.

V

For the organization and conduct of medical education, the facts which I have thus far presented are of decisive importance. If medicine accepts as its goal—however remote that goal may be—scientific standards alike in research and in practice, medical education must be conceived as primarily the effort to train students in the intellectual technique of inductive science. For the analysis, however, of the simplest situation which the ailing body presents, considerable knowledge is required; for practical ministration, still another volume of knowledge and experience is requisite. The facts in question cannot be passively learned and mechanically applied. On the contrary, an extraordinarily active and oft-repeated mental process, involving observation, sorting out, combining, inferring, trying, must be in constant operation in both the diagnosis and the treatment of disease. The teacher of medicine cannot, therefore, achieve his object by himself culling and arranging for the student the particular bits of information which are likely to be of practical utility; nor can the period of study be so prolonged as to enable the student to master any considerable part of the knowledge or technique already in existence.

Fortunately, education in science is something different from the acquisition of information and the control of mechanism; it concerns itself fundamentally with habituation to method. Knowledge is indeed necessary, inasmuch as scientific method does not operate in a vacuum. A selection must therefore be made, and, unless the teacher is perverse, it will be made with general, though by no means uniform, reference to the objects of professional training. But these essentials must be acquired, not as inert knowledge, but as themselves exemplifications of scientific procedure. Assured in the possession of this inductive technique, acquired in the process of learning the several subjects, the student will make intelligent progress. As hospital intern or as beginning assistant, the young physician

will advance quickly in knowledge and skill; reading will build him out; every bit of experience will still further enrich him.

VI

It will be plain, as we proceed, that the actual management of medical education has thus far given too little consideration to the points which I have been discussing. Whatever modifications have been deliberately introduced, accident rather than reflection or design has very largely made medical education what it now is in different countries. It just happened, as we shall see, that, for ecclesiastical or other reasons, hospitals were started in Great Britain and France; it just happened that the physician's apprentice met him in the hospital and followed him through the wards. Out of these historical accidents one kind of school developed. It just happened that in Germany, medicine, being philosophically conceived, was included in the faculties which composed the medieval, and hence the modern, university; being there, the parts into which it broke of its own weight have, in our day, developed as other disciplines—literary, historical, and scientific—have developed in the same universities; and out of this series of happenings a second educational type arose. Finally, it just happened that in the New World doctors were needed before there was any way of educating them; and a method was improvised which comforted the sick with a titular doctor, who could sign a death certificate, even though he understood little of their aches and pains. Hence, a third kind of medical school. All three are the product of circumstances. The starting point, in every instance decisive, was a matter of chance. Nowhere is there evidence of initial planning, nowhere is there proof that national genius originally selected one type rather than another.

The present volume, as the reader may already have perceived, considers medical education from a logical point of view on the assumption—even in the hope—that educational procedure is gradually modifiable—I do not say entirely and uniformly re-

constructed—in the light of reason and experience. Perhaps the quaint words of Bacon, comparing his own age with classical antiquity, may be applied to the comparative question which we are considering: "I cannot but be raised to this persuasion, that this third period of time will far surpass that of the Graecian and Roman learning, *only if men will know their own strength and their own weakness both, and take, one from the other, light of invention and not fire of contradiction.*" The easily and quickly won reforms in America are encouraging but not conclusive; for Americans are given to travel and had at best a flimsy structure to demolish. Habits, traditions, and interests abroad are deeply and firmly rooted; near neighbors are at once ill-informed and sensitive. A plausible case can even sometimes be made out by way of proving that an obvious defect is but the inescapable by-product of some characteristic virtue! In any case underlying social and educational situations must frequently be altered—a slow and complicated process—before far-reaching reforms in the medical schools can be realized. But, in the end, the direction of development is more significant than its rate.

Such critical interest in improving medical education as exists is embodied in the literature of the subject in different countries. The biographical and historical aspects are abundantly treated in all languages. A critical educational literature exists mainly in the United States and Germany, and only in the United States has it gone to the length of proposing fundamental changes. France has produced a single classic, Claude Bernard's *Introduction à l'Étude de la Médecine Expérimentale*,[4] published in 1865, which deals with the logic of inquiry, without reference to the ideals or organization of the medical school. From that day to this, French literature is, as far as medical education is concerned, almost barren. Faculty and ministerial committees occasionally take counsel; but not being prodded by lively and fearless discussion on the

[4] An English translation of this important essay is shortly to be issued by the Macmillan Company (New York).

outside, their deliberations usually result in detailed regulations which bring about only superficial modifications or additions. Assuredly the increase of knowledge and the change of outlook within the last half century justify not only adjustment, but reconstruction. In Latin countries, however, the reformer is discouraged almost to the point of total silence in the face of the prevailing inertia. It is therefore not strange that in its essential features the French type of medical education has been but superficially affected by the medical revolution of the last half century.

Nor can Great Britain boast a rich or, with a few exceptions, an important educational literature. Huxley and Foster did, however, launch a discussion, which, though rarely sustained at their level, has never died out completely. Meanwhile, governmental reports, the British Medical Council, an occasional Royal Commission,[5] and the Ministry of Health[6] have kept the pot boiling. The advantage of controversy is nowhere more apparent. Twenty years ago, English medical education was as clinical, as "practical," as that of France; but agitation during this period has wrought a change of viewpoint. More and more, as we shall see, the logic of medicine is influencing British medical education. Innovations are being tried; research has become far more widespread and productive; indeed, as funds become available, there is little doubt that a marked forward advance will take place throughout Great Britain.

Far the most abundant, helpful, and thoughtful literature is German. Billroth's *Lehren und Lernen der medicinischen Wissenschaften*,[7] published in 1876, though hardly so pro-

[5] *Final Report of Royal Commission on University Education in London* (London, His Majesty's Stationery Office, 1913).

[6] Sir George Newman: *Some Notes on Medical Education in England* (published by His Majesty's Stationery Office, 1918); *Recent Advances in Medical Education in England* (ditto, 1923).

[7] An English translation under the title, *The Medical Sciences in the German Universities*, has just been issued (New York, 1924). References in this volume are made to this edition.

found, may well rank with Claude Bernard's great book on the experimental method; his purpose is, however, different, for he discusses the history of medical education, especially in Germany, and practical problems and details, such as the internal relationships of the various subjects, the proper preparation of the student, the organization of the teaching staff, its place in respect to other divisions of the faculty, and, finally, conditions in foreign countries as far as they could be ascertained at a distance. Billroth explicitly recognizes medical education as one of the "common interests of civilized nations," and seeks to learn from other countries "be they Russia, Switzerland, or anywhere else." In addition, discussion of problems from the standpoint of education and the organization of knowledge can be found incidentally in most of the great German medical works and periodicals of the entire era. Pamphlets running into the hundreds have been issued; medical journals contain educational papers written from every conceivable angle.

Sometimes issues are beclouded by the ease with which the German glides into metaphysics; certain fundamental flaws of procedure have escaped recognition, and many valuable suggestions have been shipwrecked on the traditions of the universities. None the less, the fact that German medicine, far behind England and still farther behind France in 1850, easily led the world in 1914 is to be explained partly at least by the stimulating theoretical literature—official and unofficial—in exposition of the problems, philosophical as well as practical, of education and research. Since the war, a voluminous controversial literature dealing with educational problems has poured forth from the press.[8]

The literature of medical education in the United States has been of different character. Bowditch, Minot, and the members of the early Johns Hopkins group—especially Osler,[9]

[8] Typical are: Becker: *Gedanken zur Hochschulreform* (Leipzig, 1920), and Lubarsch: *Zur Frage der Hochschulreform* (Wiesbaden, 1919).

[9] *Aequanimitas* (London, 1910).

Welch[10] and Mall[11]—expounded in essays and addresses the ideas then taking form in Baltimore, and familiarized the public and the medical profession with the achievements of foreign teachers and investigators. Medical education and research thus became a favorite topic at university functions and at the meetings of scientific societies. Discussion of ideals, methods, and results in this vein has flourished in the United States. It is less philosophical and profound than the contemporary discussion carried on in Germany; but it was for the time pitched in the right key and has been immensely fruitful. A point has been reached, however, where something more intellectual is also needed. Very significantly, Billroth called his book a study in the history of culture. But scientific medicine in America—young, vigorous and positivistic—is today sadly deficient in cultural and philosophic background. If medical education, whether in America or in Europe, without being schematized or mechanized, without cutting away from history, is still progressively to embody the results of recent investigation, and is progressively to be modified in the direction of the logical norm, workers must move freely from country to country, and a fearless and abundant comparative literature, philosophic and practical, must be created. Uniformity will not come about and is not in itself desirable; but there is a vast difference between local chauvinism, holding to things as they are, and an enlightened spirit, seeking stimulus and suggestion, wherever they are to be found. It is upon the latter that progress largely depends. Thus, gradually, men become aware of the extent to which chance has determined development, and of the extent to which intelligent effort may reconstruct educational institutions.

[10] Welch's contributions form a large portion of Volume III of his *Papers and Addresses*, issued by the Johns Hopkins Press in 1920, on the occasion of his seventieth birthday.

[11] Mall's papers, less numerous, but highly influential, have unfortunately not been collected. Typical examples of the literature of this period dealing with the subjects regarding which public and professional opinion needed to be educated are contained in Richard M. Pearce's *Medical Research and Education* (The Science Press, 1915).

CHAPTER II

THREE TYPES OF MEDICAL SCHOOL

Medical schools have originated and developed in different ways in different countries; but, for the most part, they may for the sake of convenience be reduced to three types, roughly characterized as (1) the clinical type, (2) the university type, (3) the proprietary type.

I

The clinical type is native to France and, as we shall see, to Great Britain, in both of which the medical school grew out of the hospital. Anatomy, long the one non-clinical subject, was pursued beyond the hospital walls under teachers who, though themselves practitioners, had more time on their hands than their patients just then required. The rest of his education the apprentice obtained by following his master from bed to bed, watching him at his work, assisting him at this or that, and noting down the words that fell from his lips. In course of time physicians and surgeons selected from a number of hospitals were loosely combined to form a medical faculty which was nominally part of a university; simultaneously, however, the same kind of teaching was carried on by physicians and surgeons who were not included in the charmed university circle. The student was not so much a university student as the disciple of the master whom he followed. In this sense, students at every stage of advancement and experience mingled —and still mingle—at the bedside, or as near the bedside as they can get—beginners, just come from the provinces; hangers-on or enthusiasts, who have already for several years walked the wards; seasoned practitioners with grizzled beards, who

have returned from their native villages or crossed the Atlantic, to get in touch with some great master—Louis, for example, when French medicine was at the zenith of its glory, Trousseau in the following generation, Charcot, Pierre Marie, or Widal, in our own day.

The clinical type of medical school, wherever it exists, has as a school a simple and single object, viz., the training of doctors by practical methods. The university relationship does not fundamentally modify this purpose. The medical faculty of Paris, Nancy, or Lyons was and is, in the first instance, a group of practising physicians and surgeons, engaged in training apprentices. Their position as university professors does not require that they differ in training, activities, or aims from the teachers of medicine in mere hospital schools. Individuals may, if they please, and not infrequently do, carry on research, but their status as teachers in the university, the esteem in which they are held, the promotions that they secure, do not depend on their original contributions to knowledge. The French universities do, therefore, as institutions, little to encourage or develop medical thinkers. A man works, not because, being a university professor, he is assumed to be a productive scientist, but because, as a matter of personal interest, he cares to do so.

Not only the purpose, but the peculiar organization of the French university tells heavily against modern educational aims and values. Its management is highly centralized in the ministry at Paris, as a result of which it lacks the competitive features and relatively free play that, as we shall see, have proved efficacious in Germany and other countries. The key position in the faculty is that of *agrégé,* an official lectureship, lasting nine years. In appearance, the *agrégé* is an assistant professor or associate professor—not, however, in reality. For he is selected not by a chief, who desires his coöperation in teaching and research, but by means of a competition, which, theoretically at least, picks out the *local* applicant who gives the best account of himself before a mixed jury. Under the

most favorable conditions fluency, adaptability, and wide reading carry a heavy premium; the winners are able, cultivated, well-informed physicians, usually excellent teachers and at times brilliant scientists. Under less favorable auspices, it is openly and responsibly charged that favoritism and chance are frequently operative beneath the cloak of the "concours": "protectors are more important than masters", to quote M. Weiss, the dean of the new medical faculty of Strasbourg. Thus outstanding persons are often left outside, to make shift as best they can.[1] To the limited number of *agrégés* thus locally chosen, the professorships are restricted; [2] as there are no intermediate grades, the academic circle is narrow and inelastic. Meanwhile, the winner of the *agrégation* obtains, as such, a detached and independent academic post, that carries with it no facilities but a lecture hall.[3] To get an opportunity to carry on original work, which he may or may not be inclined to do, he must, as I shall shortly explain, secure an additional, and on the clinical side, usually a non-university appointment, preferably as hospital physician or surgeon, in the last event as assistant or laboratory chief. Without some such appointment, success in the *agrégation,* while opening the way to a professorship, may cost him his opportunities for scientific activity for the time being. From the standpoint of activity, whether with a view to practice, production or even teaching,

[1] A change in the manner of choosing *agrégés* has just been introduced: they are to be selected by the faculty from an eligible list, based on competitive examination. The change may work an improvement, but it does not yet go to the root of the difficulty.

[2] A single recent exception should be noted: M. Emile Sergent has recently succeeded in persuading the Municipality of Paris to provide an independent professorship of medicine, to which he, "not an *agrégé*—in fact a man who 'flunked' the *agrégation*"—has been promoted. M. Sergent's inaugural, triumphing over the academic organization, is given in full in *La Presse Médicale,* Feb. 4, 1922. M. Sergent calls the *agrégation* "a veritable feudal system." As an instance of the liability of the jurors to "errors of diagnosis" he cites the fact that "Claude Bernard failed to receive promotion to *agrégé.*"

[3] The professor creates his own hospital or laboratory staff, but the *agrégé* in his own subject is not, as such, a member of it.

a hospital post, awarded by the municipality[4] is therefore a more valuable prize than the *agrégation* in the gift of the university. The professoriate, not indeed without many and brilliant ornaments, not only fails to stimulate scientific medicine because, as such, it is conceived in terms of teaching; it is not even adequately representative of French medicine, because it is restricted to the local *agrégés,* whose own efforts have been too often misdirected under the necessity of preparing for an examination so general in character that it does not ascertain the distinct fitness required by modern science. The entire organization, whatever exceptions may be pointed out, is thus hostile to youth, originality, abundance or surprise. Small wonder that younger men, eager to promote modern medical science in France, fret under the prevailing system and sometimes even refuse to submit to the academic yoke, since success in the *agrégation* tends to carry men away from the type of activity upon which scientific achievement nowadays depends.

The problem is complicated and aggravated by the hospital situation. With the exception of twenty-one scattered services placed by the municipality at the disposal of the Paris faculty, the French hospitals, though freely open to teaching, live their own independent lives, making as hospitals little provision for research and only routine provision for teaching. By competition before juries which the municipal authority creates out of hospital physicians and surgeons without reference to the university faculty, the hospital physicians and surgeons of the future are chosen from time to time. An *agrégé* may win a hospital "concours" and thus become hospital physician or surgeon. In such instances, as *agrégé* he lectures at the faculty on his appointed subject, and on his personal responsibility conducts his hospital work often with a quota of clinical students from the faculty. But his teaching as *agrégé* at the faculty and his teaching as hospital physician have no necessary

[4] The hospitals are municipal institutions managed by a bureau called "*L'assistance publique.*"

connection with each other. In the hospital competition neither quality nor achievement befitting a university has been the decisive factor in the hospital appointment. The close co-operation between members of a hospital staff or teachers of the same subject and of different subjects—the "team work" of the German or American university organization—is rare and accidental in the French medical faculty; the type of organization does not make for it. Further, with the exception of the twenty-one services above noted, the numerous remaining services are filled by men, competitively selected, at regular intervals, usually years in advance of an adequate number of vacancies. Able physicians and surgeons at the very climax of their powers, having served a stipulated period as assistant in charge of a laboratory, a course, or the out-patient department, may thus go for prolonged periods, rarely less than five years, frequently six, eight, ten, or even fifteen, before they once more and as of right obtain charge of hospital beds. A call to another university is impossible. Meanwhile, as assistants, they may bridge the gap, obtaining thus access to patients and giving clinical instruction. Failing to secure an assistantship, their plight is hopeless. During this dismal period of waiting, men interested in research may indeed find a place to work; but the abundance and variety of opportunities, characteristic of the Germanic countries and of the leading clinics in the United States, are unknown in France. Indeed, the reverse is true: opportunity comes late and is limited; the incumbent must make hay while his sun shines. Nowhere in Europe has ambitious youth a harder road to travel and less assurance of finding opportunity, support, facilities, and appreciation.

II

For the first half of the nineteenth century French medicine was preëminent in Europe; at the middle of the century France produced two of the most brilliant and stimulating

geniuses the world has known—Claude Bernard, experimental physiologist, and Pasteur, chemist, bacteriologist, and immunologist. Throughout the century, France continued, from time to time, to produce clinical masters of the first rank. Nevertheless, despite the French lead and despite the tremendous and dramatic achievements of Claude Bernard and Pasteur, from 1850 on French medicine steadily lost ground to the Germans.

The explanation is to be sought in defects of aim and organization already discussed, and in failure to make proper material provision for research and teaching. So long as progress could be made by systematic individual observation at the bedside and in the deadhouse, the advantage lay with the French, for Laennec, Louis, their contemporaries and successors had command of immense clinical material, while German professors of medicine were still dominated by metaphysical conceptions. Two or three generations ago when the hospital determined the trend of medical education, this was a fortunate circumstance, for the doctor was then trained by the only method by which he could be trained at all, viz., contact with patients. But the moment that progress came to depend on the interaction of clinic and laboratory, German organization of laboratories and clinics within—and without—universities seething with enthusiasm for knowledge told heavily in the race.

In respect to material equipment, the medical sciences fared ill in France during this entire period. Both Claude Bernard and Pasteur, like Pierre Curie in our own day, waged a lifelong struggle against poverty of equipment and support. The former did his most important work in a cellar and was for the first time housed in tolerable comfort towards the close of the Second Empire, when Napoleon III presented him with two laboratories—one at the Sorbonne, the other at the Muséum d'Histoire Naturelle. The circumstances attending the benefaction are highly significant. The aging scientist was induced to attend an afternoon party at Compiègne, where he

charmed the pinchbeck emperor. The scientist, whose appeals had fallen on deaf ears at the ministry, now received his modest laboratories by personal favor, precisely as the laundress's daughter obtained her sumptuous mansion in the rue de Tilsitt. Savant and favorite were alike grateful recipients of imperial bounty; but a system of education and research cannot be built up by such capricious and disproportionate generosity. Meanwhile Pasteur luxuriated in two small attics beneath the roof of the École Normale without the assistance of even an ordinary laboratory attendant. As late as 1868, when millions were being lavished on the new Opera, he watched the credits promised for science vanish into thin air. Casting his eyes longingly across the Rhine, he wrote in that year: "Rich and large laboratories have been growing in Germany for the last thirty years and many more are still being built; at Berlin and at Bonn two palaces, worth four million francs each, are being erected for chemical studies." [5] Only in the late eighties, when he was approaching his end, did his dramatic success with hydrophobia secure for him the facilities for which he had been eloquently, but vainly, pleading all his life. In neither instance was assistance timely, nor did it spring from a reliable educational motive or policy. And, significantly, too, the institute, in which research was to be prominent, was established outside, not inside, the University of Paris.[6]

The Republic has accomplished certain improvements, but it has not pursued a bold and modern university policy. Intense conservatism preserves in higher education the forms imposed by the first Napoleon. Centralization prevents institutional competition and variety. Wars, the penalties of wars, and preparations for fresh wars have absorbed too large a share of the national resources; a strongly individualistic tradition disinclines workers to adopt the types of organization

[5] Vallery-Radot: *Life of Pasteur*, New York, p. 152.

[6] In Germany, Denmark, and the United States non-university institutes of research have also been created; but, as we shall see, for precisely the opposite reason that operated in the case of the Pasteur Institute. See Chapter XI.

which in these days enable even second-rate men to participate in a stream of continuous work, much of which may be of excellent quality. French medicine is therefore still too largely individual in origin, too largely clinical in interest.

Meanwhile now, as previously, genius, ability, and earnestness develop somehow. Charcot, undaunted by the poverty and discomforts of the Salpêtrière, launched a brilliant school of neurology; at Lyons, Arloing, Policard, and Regaud created out of almost nothing an active center of investigation. Thus, though equipment and support have become more important than ever, it still remains true that the genuine investigator triumphs over almost any obstacle. But isolated and meteoric contributions should not be permitted to obscure the loss which science and society suffer from failure to adopt the large, generous, and flexible policy by which alone the rapidly increasing possibilities of scientific medicine can be realized.[7]

[7] I speak above only of the medical faculties; but the conditions described are not limited to medicine. In his *Universities and Scientific Life in the United States* (The Harvard University Press, 1922), M. Maurice Caullery has criticised American conditions fairly and incisively; but he does not hesitate to speak with equal candor of his own people—see especially pp. 250-265. I venture to make two brief quotations:

"When the work of a (French) scientist has received public recognition, if the public authorities decide to make a contribution in order to aid the scientist to go on with research and to stimulate others to the work of scientific investigation, they establish a new chair at the Sorbonne with its paraphernalia of oral courses and, invariably, examinations and diplomas. But almost the last thing they think of organizing is a laboratory, and never sufficiently, although a laboratory would have been the most necessary and urgent of things under the circumstances. We have a patent example in Pierre Curie, for whom, after his discovery of radium, a chair was established in the Sorbonne. But he died—prematurely, it is true—without having the laboratory that was to him of all things the most indispensable." (pp. 250-251.)

"Despite their new name, our universities have not yet stripped themselves of the spirit, the structure, and the chains of the Napoleonic faculties. The Collège de France has neither the laboratories nor the resources which it deserves. The Museum of Natural History, in spite of its souvenirs of Lamarck, Cuvier, and Geoffroy Saint-Hilaire, periodically invoked, is not the museum which Paris ought to put in comparison with the British Museum, the American museums, and other large foreign museums. The

III

The English type of school did not in the course of the nineteenth century differ materially from the French, even though the French was in name a university faculty, while in England the medical school was practically independent. Both alike were pathological-clinical schools. Hunter indeed had already in the preceding century been an experimentalist of wide range, Jenner, an experimentalist in a new field—but the age was not ready for either. During the first three-quarters of the nineteenth century, Stokes, Addison, Hughlings Jackson, and others reported discoveries of great moment; but they did little to modify the current type of research or education. Investigation and teaching were practically confined, as in France, to the hospital ward and the deadhouse. The students walked the wards in the wake of a physician or surgeon with whom they contracted under the most favorable circumstances a personal relationship. They learned by watching their master at work and by helping him as they could. The differentiation of the various clinical branches and ultimately of the pre-clinical sciences gradually brought about the more orderly arrangement known as the hospital school, but the essence of the instruction remained the same. The student learned medicine by seeing it practised and by increasing participation in its details.

The differentiation of the pre-clinical sciences did not at once result in independence on their part. Anatomy and pathology were long taught by surgeons, physiology for a while at least by other clinicians. Towards the end of the last century, however, and early in the new century, it became clear that these sciences had to be presented by men who were devoted to them, and that

wealth of the past is not sufficient to assure to it the rank which it ought to hold." (p. 262.)

See also *Pierre Curie* by Marie Curie (N. Y., 1923), passim. In 1903, declining the Légion d'Honneur, Pierre Curie wrote: "I do not feel the need of a decoration, but I do feel the greatest need for a laboratory." (p. 133.)

the student had to master their elements before he could profit by clinical study. Even so, however, their independence was grudgingly yielded. The schools lacked the money and they lacked the interest necessary to the scientific development of the pre-clinical sciences. These sciences were therefore taught under the influence of clinicians and largely as mere subsidiaries to clinical training.

The British like the French hospitals continue to be freely open to teaching by physicians and surgeons rather than by professors of medicine and surgery. The clinical teachers are, with a few exceptions, to which special attention will be drawn,[8] visiting physicians and surgeons, who attend their respective hospitals a few times a week for brief periods. The hospitals are ill arranged and scantily equipped whether for teaching or research; the beds are divided into small services —thirty or forty, as a rule, of miscellaneous character; each of these small services has its own little staff—a team or firm consisting of a senior, an assistant physician serving in the out-patient department [9] unless when substituting for his absent chief, a resident serving a brief period, and clerks who at short intervals come and go.[10] Except in the clinical units, to be described shortly, appointments to the lower posts are limited to the school's own graduates; and as promotions are usually made on the basis of seniority, inbreeding is common.

Meanwhile, the atmosphere, invigorated by Darwin and Lyell, has for over half a century been disturbed by the fear-

[8] See pp. 48 ff.

[9] At some hospitals (University College, St. Bartholomew's, etc.) senior physicians also take their turn in the out-patient department.

[10] At Edinburgh, for example, there are seven general surgical services, and eight general medical services; no single service in either surgery or medicine is large enough and well enough equipped and financed to constitute a university clinic. A change in this direction is, however, under consideration. Assistant physicians and assistant surgeons are appointed by a committee of seven, on which the university has but two representatives, and these assistants automatically rise to a headship in the absence of good reason to the contrary. Under the conditions existing in England (outside the full-time units) and in Scotland, university ideals and activities are on the clinical side impossible.

less educational polemics of Huxley and Spencer and the ironic comparisons with the continent with which for a generation the pen of Matthew Arnold pricked the English people. Further, the development of productive schools of physics, chemistry, and physiology in the ancient universities—particularly, in so far as medicine is concerned, the development of the school of physiology at Cambridge—has furnished the foundation for a general advance in all the medical sciences—pre-clinical and clinical. At Oxford and Cambridge, partial medical schools were established for teaching and research in the fundamental scientific branches—clinical studies being deferred until the student, trained in chemistry and physiology, went up to London. In so far as these students were concerned, the fundamental sciences had received at Oxford and Cambridge the proper emphasis and at the proper time; most of them after reaching London succumbed to the prevailing viewpoint—that of structural and morbid anatomy; some of them, however, passing unscathed through the clinical years, returned to the universities in order to cultivate there the experimental sciences; a few carried into the clinic the point of view of modern physiology.

I have spoken of British medical schools as hospital or clinical schools. So, in effect—excepting the partial schools at Oxford and Cambridge—they really are. In form, however, they have all in recent years allied themselves with local universities.[11] On the clinical side, except for the clinical units of which I shall speak in a moment, this alliance has made little difference: the teachers of medicine and surgery are, as I have said, local consultants and practitioners, not university pro-

[11] The London situation is, however, unique. University College with its Medical School would in any other country be itself a university; clinics, laboratories, and other departments are geographically unified, and the units have introduced the university idea into the hospital. The other London schools, though included within the circle of the University of London, are, whatever their merits, still hospital schools, not university medical faculties. Nevertheless, they, too, in some instances, possess clinical units, representing university ideals.

fessors; and the hospitals, comfortable and attractive as they are, are without the facilities needed to make university clinics. On the laboratory side, however, progress has been made. In theory, and in many institutions in fact, the underlying sciences have now emancipated themselves from the hospital. Conservatism, vested interests, absence of true university ideals, lack of resources, lack of leadership, and excessive dependence on tedious committee procedure, are, to be sure, still obstructive. But it is not too much to say that if, at this moment, Great Britain possessed the necessary funds, an evolution, startling in its rapidity, would take place. Could the medical school at Cambridge be completed on a daring basis, English medicine might react as American medicine reacted to the stimulus of Johns Hopkins Medical School.

For such an event preparations are at any rate making. The English government is in its own way moving in this direction. It is quietly putting a certain amount of pressure on the profession and the schools; and it is beginning to invest public funds in medical education and research. At several of the London schools and at Cardiff university clinical units, to which I have just alluded, have been established. The London units are typical. For these the several schools involved set aside a larger number of beds; through gifts and government appropriations funds have been obtained with which to support a professor acceptable to the University of London, a small staff, and laboratories in which a beginning can be made in systematic research. Thus side by side with the traditional hospital organization a modern conception has been embodied. The line has been broken; strangers have been called in or promoted; university ideals in teaching and research have been definitely set up. Diplomacy and tact are to some extent procuring for the full-time staff the larger amounts of specialized material which they require and which an improvement in hospital organization would automatically supply. Time will tell whether English and Scottish hospital managers can be brought to see the superiority of the unit as a type of organization, and

if so, whether funds can be procured liberally enough to finance the units more adequately and more widely. To this point I shall have occasion to recur later.

In addition the government has set up, under the jurisdiction of the Privy Council, the Medical Research Council, through which young research workers are maintained in various laboratories and clinics throughout the kingdom. In most places, where active investigation is going on, the beneficent and intelligent coöperation of the Medical Research Council may be discovered. With part of its funds the Council has even started a research institute at Hampstead.[12] A considerable body of workers is thus in training. Though the country is still conservatively inclined, British medicine, based on morbid anatomy, is undoubtedly under these influences consciously moving towards the larger conception of scientific medicine.

IV

The second or university type of medical school developed in Germany,[13] Scandinavia, Holland, and German-speaking Switzerland. Its point of departure was the lecturing university professor, authoritatively expounding the traditional lore. Nothing could have been further from the conception or method of modern science. How came it, then, that, while medicine and surgery continued in England and France to be taught on a practical basis, in Northern Europe, they suddenly, breaking away from both authority and speculation, struck out for themselves as experimental sciences?

The explanation is to be found in the character and ideals of the Germanic university in the nineteenth century. The French and Scottish universities were primarily teaching institutions; their medical faculties did not, therefore, in the nineteenth century differ substantially from the English hospital

[12] See Chapter XI.

[13] Including Austria-Hungary.

school: both were hospital staffs engaged in teaching.[14] The German university, during the same period, gave as much emphasis to research as to teaching; indeed, eminence in investigation became the accepted basis of promotion as university teacher. The German professor was not simply a teacher, perfunctory or efficient, communicating his lore or his technique to successive groups of students, who in due course became practitioners of medicine. He was a master, impregnated with scientific ideals by prolonged training in scholarship and science, who surrounded himself with devoted disciples, serving with enthusiasm long years as students, assistants or *Privat-Docents,* on incomes hardly enough to sustain life. Thus the great masters in every field formed schools of thought, stable enough to work out ideas—occasionally, so stable as to become temporarily obstacles to progress.[15] At the moment when this conception of the university ideal was definitely formulated, medicine held a university professorship in the same sense as theology, Greek, or natural science. Precisely as the student of Greek won a university chair by his researches in the field of philology, the student of medicine could hope for recognition and promotion as teacher, largely on the score of original work in anatomy, pathology, or internal medicine. The Scottish biographer of Helmholtz lays hold of the essential fact when he explains that part at least of the marvelous activity of Helmholtz arose "from the intimate connection between the function of a professor, whose duty it was to teach, and that of the original investigator. He investigated because he wished to speak of matters at first hand. Again and again he took up a problem, so that he might master it himself and be enabled to make it clear to his pupils." [16]

[14] The Scotch universities had, however, long possessed chairs of anatomy, quite independent of the infirmary or hospital staff.

[15] For an impressive demonstration of the success of German organization in developing productive schools of workers, see Billroth (loc. cit.), pp. 216 ff., where the scientific genealogy of the great workers in each of the medical sciences will be found. Billroth also fully recognizes the debt due to French, English, and Dutch workers.

[16] J. G. McKendrick: *Life of Helmholtz* (London, 1899), pp. 130-131.

It is interesting to note how rapidly, once the fundamental importance of successful research to the ambitious teacher was established, the requisite facilities, clinical and laboratory, were obtained, and how rapidly differentiation and specialization took place. The beginnings go back a full century to Purkinje's physiological laboratory at Breslau started in 1824 and Liebig's chemical laboratory at Giessen started the following year. Virchow's institute of pathology (1856) was rapidly copied by other German universities. Physiology, chemistry, and pathology—and subsequently pharmacology and bacteriology—were not only subjects to be taught to professional students, but domains to be explored. In 1850—less than three-quarters of a century ago!—Johannes Müller taught at Berlin all the pre-clinical sciences. As knowledge advanced and as university promotion came more and more to depend on conspicuous participation in its advance, the vast territory which Müller administered was divided. Within an amazingly brief period, medical science thus profited enormously by the accident that in Germany it started not in a hospital, but in a university in which research was as prominent as instruction. The development which I have sketched took place in the clinic as well as in the laboratory. The clinician developed precisely as the anatomist and the physiologist developed. He too was a university professor; his clinic was a university institute—and this regardless of whether it was located in a state, a provincial or an endowed hospital. Moreover, his training deliberately aimed to make him a successful investigator. The men who developed scientific medicine and surgery in Germany were, in the first place, soundly trained in anatomy, physiology, chemistry, and pathology—many of them, indeed, had won their spurs in one of the medical sciences before passing on into the clinic. Thus the university faculty was numerous, differentiated, and yet unified. With the outburst of creative energy characteristic of Germany from 1866 on, the German universities severally obtained scientific institutes and clinics equipped with the laboratories that became successively necessary and

appropriate. The German conception of medicine as a university faculty, in a university equally bound to teach and to investigate, was thus admirably embodied in the equipment, spirit, and activity of the medical faculties.

The organization of the German faculty, while not by any means perfect, is relatively favorable to the free development and exploitation of talent. The German faculty consists essentially of a small group of head professors—*Ordinarii,* so called—in whom complete control of official instruction, resources, and facilities is lodged—an arrangement which, as we shall learn, is not without its drawbacks. The professor is chosen by the minister of education—as a matter of custom, from lists of three, submitted independently by the faculty and the teachers below professorial rank.[17] Assistants are chosen by the professor; he looks over the ground and puts together his staff at will. Inasmuch as his own reputation, in which promotion, and to a certain extent, income, are both involved, depends on the success of his institute,[18] he has strong reasons for selecting able and promising assistants, though, being human, he may and at times does prefer congeniality to originality. On meager pay these assistants often remain for years; their success as aids and investigators mainly determines their own future. Outside the circle of the *Ordinarii* and their official assistants, associate professors, honorary professors, and *Privat-Docents,* nominated by the faculty, some drawing modest salaries, others wholly dependent upon fees derived from voluntary courses, make up the roster of the university faculty. Some of these title-

[17] In Scandinavia, likewise, machinery has been devised for the purpose of bringing in, from whatever place, the strongest candidate. Sweden and Denmark both employ committees of experts in the subject concerned, among whom there are always foreigners. Thus, the committee appointed to report on the qualifications of a candidate for a professorship at Stockholm or Copenhagen would contain a Norwegian, a German, or other outside authority. In Sweden, the members write elaborate opinions, which are printed in a volume, read and discussed by the faculty, before a recommendation is made to the minister. The professor, once appointed, organizes his own department, practically on his own responsibility.

[18] The German laboratory or clinic is known as an "*Institut.*"

bearing instructors are quite without teaching and research facilities—a hardship due partly to the number and enthusiasm of the workers and partly to the attitude of the professor; others enjoy appointments in university or non-university laboratories and clinics which they use freely for such courses as they offer and such research as they are interested in prosecuting.

The scheme above described is open to criticism as too oligarchical; yet it is at once the most flexible and capacious yet devised. Universities, though of the same general type, are numerous and competitive. Thus within the same general type of institution healthy competition exists; new points of view get a foothold somewhere, and are in time carried hither and thither, as students wander and teachers are called. Moreover, while, within a given university, the several institutes—whether laboratories or clinics—are highly centralized, the quality of non-university institutes and the rank and importance of those who conduct them tend, especially in large centers, towards decentralization. No other type of organization offers equal incentive or opportunity to scientific workers of almost every description—official appointees, volunteers, foreigners. And promotion is in general open to any one who succeeds anywhere.

By the year 1910, when German medicine may be said to have reached its zenith, practically every one of the German universities possessed independent, competing, well-equipped, well-organized, and well-supported laboratories, representing anatomy, physiology, pharmacology, pathology, and hygiene, including bacteriology and legal medicine, and separate clinics, each with laboratories, staff, and budget, in medicine, surgery, pediatrics, obstetrics and gynecology, psychiatry,[19] dermatology, otology, and ophthalmology. A wholesome rivalry existed between the various kingdoms and principalities—for education in Germany is essentially under state, not under imperial, control. A petty principality could thus aspire to develop a university, out of proportion to its size and wealth, precisely

[19] In some universities, neurology also possessed similar facilities.

as it could develop its own opera—a development which we Americans may well undertake to emulate in the several states of the Union.[20] Differences, of course, existed in the German universities. Some were newer, some were larger, some were better than others; but even the least pretentious were good and the best were unsurpassed. They had, also, their ups and downs; now Berlin, now Göttingen, now Leipzig was on the whole the more active. Departments too had their vicissitudes: the strong and fertile department today might become unattractive and sterile a decade hence. But the wandering of students, the calling of professors, above all, the importance attached to reputation and achievement, were certain sooner or later to cure local inertia. The output was enormous in quantity and necessarily varied in quality; in general, however, while exceptional men everywhere were fertile, no other nation has equaled Germany in the volume or the value of its scientific output in medicine during this period. Moreover, the common practice of inducing promising young men to migrate by offering improved opportunities tends, not only to raise the level, but to produce an approximate uniformity at a high level. Nor has this movement been by any means confined to the universities. Municipal hospitals and public health agencies, tenanted by men trained in the atmosphere of research, frequently provided themselves with scientific equipment and established conditions favorable to scientific investigation.

Despite their smaller resources, other Germanic countries exhibit a corresponding development: Sweden at Stockholm, Upsala, and Lund; Denmark at Copenhagen; Holland at Utrecht, Groningen, and Leiden; Switzerland at Bern, Basel, and Zurich kept up creditably with the German pace. Indeed, no finer facilities have been provided in Germany or Austria than the Rigs-Hospital and the adjacent laboratories in Copenhagen. If institutes and clinics in other places are older,

[20] The same splendid emulation is characteristic of the tiny Swiss cantons, which have developed, relatively to population, even more universities than Germany, and of the same general type.

smaller, and simpler, they have nevertheless been productive centers of medical progress. In the absence of barriers, students and professors migrated freely; thus approximately the same high level was maintained throughout Northern Europe.

The German horizon was, however, not absolutely untroubled. With the turning of the century, there was, here and there, evidence of coarsening; the plane of rivalry was at times lowered; there was too much straining after productivity in bulk.[21] In 1912, distinct murmurs were heard that, at a time when research was becoming more and more costly, the laboratories were being stinted for the sake of the warships which now lie in twenty fathoms of water at Scapa Flow. The machinery of appointment giving the initiative to the faculty, which might be overruled by the ministry, worked well, on the whole, so long as the minister acted through a powerful and farseeing chief like Althoff. Even in Althoff's day, however, political and sectarian disqualifications were not entirely unknown; socialists and Semites, whatever their scientific qualifications, were rarely admitted to the select company of the *Ordinarii*.[22] The individual, family, sectarian, or political factors, which under the most favorable conditions occasionally tilt the scale, are said latterly to have weighed somewhat more heavily. The method of selection has not been materially changed; but now and then a second-best, a friend, a son-in-law, or a veteran past his prime received a promotion which should have gone to youth and promise. Finally, even before the war, the money craze was plainly beginning to be operative. The German professor had been traditionally a simple creature, leading a frugal life of devotion to teaching and learning. The Empire deliberately set to work to attach to its own political fortunes the brains of the universities. Honors were freely distributed; especially the professors of the

[21] Ehrlich had a motto, more and more important to remember, as facilities for research and publication become commoner: "*Viel arbeiten, wenig publizieren.*" (Marquardt, loc. cit., p. 63.)

[22] I.e., the full professors.

clinical subjects became the friends of the princes—royal or industrial—who were their patients. They earned large incomes and led busy lives—still able teachers, to be sure, still active investigators, but now carrying on both teaching and research under the handicap, unfortunately, of social and professional ambition.

The war administered a serious check to university medicine in Germany.[23] The struggle for existence has intensified competition and lowered its tone. Personal, sectarian, and reactionary machinations have, it is said, become more mischievous; anti-Semitism is no longer disguised; the authority of the state has declined, that of cliques become more powerful. Money is lacking; apparatus, supplies, animals, books, periodicals are well nigh unobtainable. The universities are thronged with students—many of them, partly or wholly self-supporting—but these must necessarily equip themselves to practise medicine rather than to carry on research. Meanwhile, there the German universities stand—still as a group the best organized, the best equipped, and the most soundly conceived that exist. Neither teaching nor research has stopped. With a tenacity that shows how deeply rooted in the national consciousness is the respect for learning, scientists, young as well as old, are struggling to produce. For a moment after the revolution there was perhaps danger that, under the illusion of democracy, university standards might be lowered; thanks to the intelligence of the popular leaders, the menace soon passed. Amid desperately discouraging conditions, the German people realize now, as in the Napoleonic period, that their way out lies through science and learning. In the distress of the next decade the universities will unquestionably suffer seriously; but if the light can be kept burning, they may emerge purified of some of the elements which, already prior to 1914, threatened—or had indeed already be-

[23] Its financial reverberations have also made serious difficulties for countries like Switzerland, Denmark, Holland, and Sweden, whose currencies have continued stable. See Chap. XII.

gun—to corrupt them. Nor is this a matter of consequence to Germany alone; the rest of the world, New and Old alike, is far from ready to dispense with the stimulus and opportunity for which the German universities were freely sought by students of all nations from 1870 on.

V

I have said that medicine in Germany and adjacent countries obtained such facilities and support as it did not obtain—and indeed has not on the whole as yet obtained—elsewhere. But the fundamental and antecedent difference between Germany on the one hand, and France and England on the other, was not difference in resources, but difference in ideals. At the outset—say, three-quarters of a century ago—the historic English universities were rich corporations, while most of the German universities were pathetically poor. As recently as 1870 or thereabouts, British inertia was unaffected by Huxley's insistence that "as for works of profound research on any subject, a third-rate poverty-stricken German university turns out more produce of that kind in one year than our fine and wealthy foundations elaborate in ten." [24]

The contrast which I have made between medical education in France and Great Britain, on the one hand, and medical education in the Germanic countries, on the other, is at times explained by opposing individualism to organization. The French and English, it is argued, achieve by individual effort; the Germans, by organized effort. But, as must now be clear, organization is just as definite in France and England as in Germany; it is only poor organization, ill-adjusted to the conditions under which the medical sciences can be most effectually taught or advanced. The issue does not, therefore, really lie between organization and non-organization, but between poor organization and better organization. The poor organization obtaining in France and England has forced strong individuals to develop outside.

[24] Address on *Liberal Education.*

But genius is rare and loneliness usually depressing; proper organization would simplify the situation of the worker: it would provide him with facilities, resources, colleagues, and pupils; it would also enable the gifted teacher to turn mediocrity to uses above the level which it could otherwise attain; [25] it would even find an appropriate niche for the solitary investigator who does best alone. Thus good organization utilizes more types of ability and interest than does poor organization.

Broadly taken, then, medical education in Great Britain and France arose out of practice, while in Germanic countries it derived from learning. In the former, there was no sharp line between the practising and the teaching profession. The practitioner taught—and, if he pleased, investigated. The best of them—Hunter, for example, Bright, Lister, and Horsley—were, like their great French contemporaries, excellent physicians, stimulating teachers, and brilliant investigators. But their situation and environment, instead of helping, progressively impeded them. They led a double life, practice and teaching seriously encroaching on interest in investigation. The physician, as such, has never been highly esteemed in England; the rank of his patients rather than the scientific value of his work gives him such social consideration as he obtains. In Germany, on the other hand, the university professor of medicine as of other subjects was as such a dignified and important figure. His university status carried the same implication and obligation in the matter of research as it carried in respect to teaching. He had from salary and fees a decent income; he was a pensionable state official in a country in which officialdom resembled an order of nobility. He was thus set off in some such fashion as a senator, a diplomat, or a military officer. And inasmuch as he had attained the company of the elect through contributions to knowledge, medical

[25] "Average people come to nothing if they are not systematically helped to reach a level where they may render important service to the community. . . . The power of Germany, for example, is due above all to a useful development and judicious utilization of individuals of average capacity." Caullery, loc. cit., p. 246.

science received in Germany a stimulus such as it had enjoyed nowhere else.

VI

A third type, already so discredited as to have become absurd, is associated with the New World, where an unprecedentedly rapid expansion of population over an enormous territory created a demand for doctors long before there existed facilities for their proper training or means for their proper support. The inevitable happened. Loose and shifting bands of practising physicians, calling themselves a faculty, tried to impart, chiefly by lectures, to heterogeneous, uneducated groups of students the empirical knowledge—sound and unsound—which they themselves possessed. First and last, American towns have produced over four hundred such medical schools. The teaching of medicine on these terms was, directly, in cash, and indirectly, in prestige, a profitable business. In time the medical profession—to its credit be it said—undertook itself to set its own house in order, and with such marked success that schools of this extreme type have within the last decade practically disappeared. But consequences of the educational chaos in which for seventy-five years the country and the medical profession were involved are still in evidence. Pioneer conditions explain how the physicians of that day came to manufacture by the thousand doctors who had had small chance to acquire either knowledge or skill. The medical profession now knows better; but large sections of the people have not yet unlearned the bad lesson they were then taught; so that medical sectarians employing a technique compounded of illusive promises, bragging, and advertising, operate profitably on a scale that would have amazed, perhaps even shocked, the regular profession in the heyday of proprietary medical education.

It was an improvement when the proprietary medical school, long suspended in mid-air, an affair of lectures, quiz, and cram, tended more or less doubtfully to settle about a hospital. In the retrospect, the condition—an advance though it was—looks

strange enough. Hospitals had been set up by municipalities, religious organizations, or philanthropic societies. Staffs, huge, unorganized, unpaid, unassisted, had been put in charge; appointments went variously—by political pull, by personal favor, occasionally even by merit. To accommodate everybody—or if not everybody, then as nearly everybody as possible—the terms of service were short, frequently not more than two or three months annually—as a result of which the more enterprising physicians and surgeons could be attached to several hospitals without conflict of hours or duties. These active gentlemen, physicians or surgeons to this, that, and the other hospital, necessarily became, in virtue of their control of clinical material, professors in one or another, sometimes in one after another, of the local medical schools. Intense competition developed between rival local faculties. A medical faculty in the eighties was thus composed of practitioners who held forth on the theory and practice of medicine at the school building where the students also dissected, and once or twice a week, during their rotating periods of service, gave a demonstrative clinic in a distant hospital amphitheater. Some schools used in this way a variety of hospitals; and frequently enough different schools used the same hospitals—a condition from which we are not yet free. The schools were usually outright proprietary affairs; annual sessions were short, and fees were low, but students were numerous and expenses negligible, so that there was a sizable sum to be shared annually among the professors. Eminent men developed somehow even in the mess we have described. A kindly critic, saved by his own ability and prolonged study in Germany, thus apologizes for them: "One can decry the system of those days—the inadequate preliminary requirements, the short courses, the faulty arrangement of the curriculum, the dominance of the didactic lecture, the meager appliances for demonstrative and practical instruction—but the results were better than the system." [26]

[26] W. H. Welch: *Papers and Addresses* (Baltimore, Johns Hopkins Press), Volume III, p. 289.

The proprietary medical schools of the United States just described were mainly private businesses. A few of them—Harvard and Pennsylvania, for example—were in name and in law university departments, but they lacked university standards, ideals, and facilities. At the very beginning of his Harvard presidency, Dr. Eliot began the struggle to make of Harvard Medical School a genuine university department in this sense. Similar steps were subsequently taken elsewhere. The movement did not, however, gain great momentum, until in the last decade of the century Johns Hopkins Medical School, a university faculty in approximately the German sense, made a success in Baltimore. The lines on which the school was developed had been previously laid down by the president and trustees and their counselors; they were distinctly enunciated when the university was opened in 1876. Even so, within the field of medicine, Johns Hopkins Medical School was a bold and at the same time a singularly naïve departure. Its faculty was a group of young men whose training in England, France, and Germany made them painfully aware of the wretched conditions generally obtaining in the United States. Without asking themselves whether their plans harmonized, or did not harmonize, with our native genius, whether they were, or were not, a natural development out of existing conditions, whether on the terms proposed they could, or could not, recruit either a teaching staff or a student body, they welded in a new pattern the soundest features of French, English, and German medical education, doing, without thought of consequences, the logical, rather than the prudential, thing. It is true that at Harvard, Pennsylvania, and Ann Arbor, distinct signs of improvement had previously shown themselves. But the gap was far from bridged when, in the early nineties of the last century, the new institution was created out of hand at Baltimore, and it was significant, not because there had been no outstanding figures elsewhere, but because here for the first time a small faculty embodied a sound university conception.

Though the modern conception of medical education made its way rapidly, nevertheless as recently as a decade ago a discussion of medical education in the United States and Canada concerned itself largely with the exposure of scandals and the inculcation of obvious truths. That era has practically passed, even though, outside the profession, quackery is still rampant. The medical schools of America, now fewer in number—though still unnecessarily numerous—are almost all in form, and sometimes in fact, university departments. In quality, the variation, however, is still enormous. A few, at the top, have procured splendid laboratories and increasingly satisfactory hospitals in the major—but only the major—clinical branches; others, ambitious and progressive, are held back partly by lack of money, partly by lack of clear ideas; those at the bottom, weak in staff, facilities, and ideals, struggle at any rate to enter better academic company. The desire to cultivate scientific medicine has become widespread; in places the volume of production is large and the quality high.

In respect to organization, American medical faculties give great prominence to two officers who, even if they or their equivalents exist, are abroad merely perfunctory, viz., the university president and the faculty dean. In the absence of the continental educational ministry, to which faculties look for coöperation and support, American universities have had to contrive their own leadership. The officials in question—the one, the chief executive of the university, the other, the executive of the medical faculty and the medium of communication with president and trustees—may be powerful for good or ill. Under an uninspired dean or a president without especial interest in medicine, conditions may long remain stagnant, or may actually deteriorate; in such cases the absence of central or of faculty direction may be seriously felt. But a president with vision, especially in coöperation with a dean who possesses the requisite scientific equipment and the confidence of the progressive elements of the faculty, can transform an old situation or create a new and stimulating model. President

Eliot of Harvard accomplished the former; President Gilman of Johns Hopkins the latter. The suddenly increased resources and the thorough educational reorganization, notably exemplified during the last few years by the medical departments at Yale and Iowa, have not happened miraculously; they have been due partly, no doubt, to a general forward movement, but in no small degree also to enthusiastic local leadership, almost invariably embodied in the executive officer of the faculty. Nor could they have taken place so rapidly and so thoroughly in any other land.

The arrangement just sketched is not free from peril. It is, in the first instance, not easy to find in the medical faculty a person who possesses at once executive talent, fine appreciation of scientific achievement, and the requisite contacts with scientific leaders. Once found, men so highly endowed ought not to be lightly sacrificed to executive routine, to which, unfortunately, the American is a singularly easy victim. On the other hand, conditions being what they have been and are, American faculties would, in the absence of competent and continuous leadership, either stagnate or flounder. Perhaps as university ideals become clearer, faculties more homogeneous, support more generally adequate, and preliminary education more efficient and more truly selective, the executive duties of the dean may be devolved upon a secretary, to whom will be left the operation of the machine, itself, let us hope, greatly simplified;[27] under such circumstances, the dean may be saved to science, without wholly surrendering the principle of effective representative leadership.

Faculty organization in America varies somewhat, according as one deals with laboratory or clinical appointments. The former are now quite generally made as are other university appointments. The faculty concerned searches the field and makes its recommendations to the president and trustees, who,

[27] Many details would disappear if the medical faculty realized that it is part of a university, not of a secondary school; many matters now handled in the office of the medical faculty could be better handled in the general offices of the university.

though at times satisfying themselves by independent inquiry, almost invariably accept suggestions that originate in this way. Once appointed, the laboratory chief is practically supreme in the organization and conduct of his department within limits fixed mainly by his budget. In theory, the search for professors is objectively made; yet not infrequently, the scale tilts in favor of the institution's own graduates, partly because institutional loyalty is in America absurdly strong, partly because, inasmuch as students do not wander, faculties are apt to know their own graduates best, and most favorably. In these instances, institutional "loyalty" gives the preference to the school's own graduates, instead of (other things being equal) to persons who, having been trained elsewhere, might introduce new ideas and points of view. Thus it can and does happen—sometimes indeed the greater the school, the more common the offence—that a college graduate will study medicine in his own university, become an instructor and rise to a professorship practically without having left his Alma Mater—a kind of career unknown in Germanic countries.[28] Inbreeding of this kind fatally narrows the horizon; genius alone can survive it. Precisely the opposite policy is for most men sound. They should pursue diverse, not uniform, courses of training; they should wander as students; professorships should be bestowed only on those who have won their spurs elsewhere than among their friends and comrades, by whom they are apt to be over-valued. Every department, incomplete at best, as it is bound to be, should seek to strengthen itself by drawing in something from the vast outside.

In a few institutions clinical heads have been chosen in an objective manner; that is, where hospitals have been es-

[28] Just as in America a Johns Hopkins or Harvard man may thus be advantaged, so in England, an Oxford, a Cambridge or a Guy's man has, in his own institution, "the inside track." By contrast—and, as the results show, a profoundly important contrast it is!—there is on the continent no such thing as a Berlin, a Tübingen, a Leiden or a Stockholm "man." There are at the moment manifestations of state particularism in Germany, as a result of the war; but this is a different and probably transient phenomenon—damaging, however, while it lasts.

tablished for teaching purposes, university principles have been followed in choosing clinical professors. But most American teaching hospitals, like the London hospitals, have long histories as local philanthropies. The process of converting philanthropic institutions into university clinics is necessarily gradual, for abrupt and complete transformation might imperil local interest and support. In Great Britain, Canada, and the United States, certain hospitals have either given universities the right to attach the appropriate hospital post to the corresponding university appointment or have arranged a joint committee to pass—usually as a matter of form—on university nominations. In outward aspect, hospitals thus become university clinics; but in practice, universities still have to tread cautiously. In few places is the tie strong enough to stand a strain; the hospital authorities have even been known —as has recently happened in Montreal [29] —to make a commitment in advance of action by the university or the joint board. In general, there is good reason for satisfaction if one by one the main clinical departments can be reorganized on a university basis. In a few cases, remarkable progress has been quickly made; thereupon, for a while, a breathing-spell has been necessary, before the process of reorganization can be carried further. Meanwhile, in other clinical departments of the same school, the local profession continues to be utilized. Institutional and local loyalties are, however, difficult to extirpate; even clinics under university control from time to time have a curious way of "loading the dic" in favor of local alumni, whether of the college or the professional school. The clinical staff, devoted as it may be, has thus many of the marks of a club—and considerations befitting a club are sometimes not without weight, even where the university is supposed to have a free hand.

[29] Similar incidents occur in Amsterdam where the university is a municipal affair. The town council must ratify professorial nominations made by the respective faculties. The council has, however, rejected nominations made by the medical faculty, substituting professors of its own choosing.

VII

The clinical side of the university medical school presents, as must be clear from the preceding account, a peculiar problem. The hospital is a public charity; its patients are its prime concern; its staff stands therefore in a personal and community relationship, which has no counterpart in the faculty of arts and science. None the less, clinical teaching and research are as important as, and more complicated than, teaching and research in Greek or physics. We have studied the situation of the professor of medicine in the large centers —in Germany, France, Great Britain, and America. Professors of medicine and surgery are presumably men of unusual learning and skill; their services are therefore apt to be sought, not only in serious matters, but in relatively trivial situations, by those who possess the means. Thus social relations are formed which tend to draw the clinician out of the academic environment. We have observed how for over a century this insidious process has in Great Britain, with an occasional exception, converted the brilliant clinical scientist into a notable social personage; how in Germany during the last thirty years, despite the firm academic anchorage on which I have dwelt, the successful professor of the clinical subjects has time and again drifted away from his clinic and his laboratory; [30] how in America, lack of opportunities for scientific work on the one hand, and social complications on the other, have prevented the development of schools of clinical thought. Now and then, indeed, an individual has in a great American city, as in London or Paris, clung fast to ideals; but far more commonly a promising start has resulted in an ultimate surrender. Meanwhile, the pre-clinical scientific laboratories have been training men competent to establish clinical

[30] In recent years, many university professors have established private clinics, managed as business enterprises by "*Oberinnen*" ("Lady Superintendents"). Many of the university clinics—e.g., the Charité in Berlin—possess private wards. Thus the professional preoccupations of clinicians make sad havoc with professorial duties.

schools. One might leave the solution to a slow evolutionary process—obviously already started in America—or one might endeavor to abridge the evolutionary process by setting up summarily the conditions necessary to scientific development on the clinical side.

The latter alternative was adopted in the form of the so-called full-time or university plan—an experiment, the history of which is, however, not quite so brief as is commonly supposed. It is a matter of record that a century ago Louis withdrew from private practice in order to concentrate his energies on the study of tuberculosis,[31] the treatment of patients and the teaching of students. Billroth, himself persuaded of the importance of practice, called attention to clinicians who had voluntarily renounced it.[32] The great German physiologist, Ludwig, was accustomed to tell his pupils that university clinicians must be freed from the distraction incident to private practice. He himself pointed out that at the time his suggestion was impracticable, because the university clinics did not contain the requisite clinical material. This was a valid objection at a time when only the abject poor resorted to a hospital, and not even they until they could no longer resist. But a modern hospital, with a comfortable and expeditious out-patient department, with public, semi-private, and private beds, is adequately representative of both social and clinical conditions. Meanwhile, private consulting practice offers little else, and that usually under conditions that impair its scientific or educational value. In America the issue was first presented—and the arguments have never been more persuasively stated—by Professor Lewellys F. Barker in an address on *Medicine and the Universities,* given in 1902.[33] When, in 1909, the Hospital of the Rockefeller Institute for Medical Research was

[31] See Faber: *Nosography* (N. Y., 1923), p. 41.

[32] For his arguments on the other side, see loc. cit., pp. 263 ff.

[33] Published in American Medicine, July 26, 1902, and reprinted in Pearce's volume, already referred to. For a later discussion by the same authority, see *Some Tendencies in Medical Education in the United States* (Journal of American Medical Association, Aug. 19, 1911, pp. 613 ff.).

established, express provision was made that no member of the staff should engage in paid private practice. Subsequently, in 1913, Johns Hopkins Medical School procured the funds which enabled the university to maintain a full-time group in medicine, surgery, and pediatrics.[34] At almost the same moment (1915) the Medical Research Council, independently of the American movement, provided Thomas Lewis with the modest salary, on the basis of which he became a full-time teacher and investigator at University College Hospital (London). Since that date, to quote scattered examples, psychiatry and obstetrics have also been placed upon precisely the same basis at Johns Hopkins; medicine, surgery, obstetrics, and pediatrics, at Yale and at Washington University (St. Louis); psychiatry and pediatrics at Iowa State University; medicine at McGill University, Montreal,[35] medicine and surgery at University College, London, and St. Bartholomew's; medicine at St. Thomas' and the London Hospital; medicine at Cardiff, in Wales; and obstetrics at the School of Medicine for Women, London. Further extensions of the principle are in

[34] The language in which the purpose of the Johns Hopkins Faculty of Medicine was described is as follows: "The faculty of the Medical School are fully convinced of the wisdom and necessity of commanding the entire time and devotion of a staff of teachers in the main clinical branches, precisely as the school has since its beginning commanded the entire time and devotion of the teachers of the underlying sciences; we are persuaded that the time is ripe for the step in question and we are desirous of undertaking the innovation. The departments of medicine, surgery, and pediatrics would be organized on the full-time basis—that is, the professor and his staff, consisting of associate professors, associates, assistants, etc.—would hold their posts on the condition that while engaged in the service of the university and hospital they accept no fees for professional services. They would be free to render any service required by humanity or science, but from it they would be expected to derive no pecuniary benefit. Fees charged by the hospital for professional services to private patients, whether within or without the hospital, by members of the full-time staff, such as at present are paid directly to the physician, would be used to promote the objects for the attainment of which this request is made."

[35] It is interesting and significant that the suggestion to create a full-time professorship of medicine at McGill emanated from Sir William Osler, who had begun his career as Professor of Medicine at McGill; at the time (1919) he was Regius Professor of Medicine of Oxford.

sight at the University of Chicago, the University of Rochester, and Vanderbilt University. Over thirty full-time clinical chairs, in the strictest sense of the term—many of them with numerous full-time assistants—can at this date be enumerated in the United States, Canada, and England. In the United States, members of the full-time staff are so salaried that the hospital and the medical school command their entire time for the care of patients, for the instruction of students, and for research. Meanwhile, *no limitation whatsoever is placed upon the instructor's freedom to see and treat patients inside or outside the hospital in order to gain experience or to render service*—a provision of great importance, often, however, overlooked by critics of the full-time system; he is simply freed from the necessity of earning any part of his livelihood by private or consulting practice—free, that is, to devote himself in what is for him the most effective fashion to the care of patients, the training of his pupils and the increase of knowledge.[36]

[36] For practical reasons affecting relations with the practising profession, it has been found desirable in the United States to charge a moderate fee in case a member of the full-time teaching staff renders a service to a private patient able to pay. Such fees are assessed by the hospital and paid into the medical school treasury, where their identity is lost. They are like student fees. The full-time clinician is indifferent as to their size or amount, and is, as a matter of fact, as uninformed about them as he is about any other item in the school's accounts. Hence there has developed no tendency on the part of either school or hospital to exploit the full-time clinician and thus, indirectly, abridge his freedom, though the contrary has sometimes been alleged by persons unacquainted with the facts. How little of educational or scientific value there is in ordinary consulting practice is obvious from the modest sums that have been collected from this source. (See p. 323.) It was originally argued that, as the payment of a fee constitutes a sort of personal bond between physician and patient, the latter would resent payment to the institution instead of to the individual. The Mayo Clinic proves the reverse, as does experience with full-time departments up to date. The truth is that sick people wish to get well and are not likely to quarrel with minor arrangements, provided they are healed. It may be that the obligation which the patient does not wipe out by payment of a fee to the full-time clinician, who is interested in him, may lead to a substantial interest in medical education and research precisely because they have been stripped of business or professional motive.

An important distinction is, however, to be observed, between the full-time organization in the United States and the British clinical unit. In the former, the full-time staff is in complete control of all the resources of the clinic—beds, out-patient department, and laboratories. It is large, well-supported, and differentiated. At the least it consists of a professor in general charge, associate professors, each responsible for a ward and some one type of laboratory work, and younger men—assistants, residents, and interns—who usually rotate through the entire service, thus obtaining a varied training. The professor or chief of service adds to this group part-time men at will, thus procuring for the school and hospital, whether in respect to care of patients, teaching or research, any further type of ability or experience desired that is available. The part-time group is lacking in some clinics, while it is prominent in others, according to the preference of the chief, the nature of the opportunities, or the type of talent that may be enlisted. The system is thus flexible, though the head of the service and his immediate helpers form the nucleus in control.

In London, the general hospital organization continues to consist of the consultant group, with a few young and rapidly shifting assistants. A service has, however, been set apart for the full-time professor, who has a few, sometimes no, full-time assistants.[37] The two types—part-time and full-time—thus exist side by side, each supreme in its own wards. A fine cooperative spirit has, however, developed, so that the clinical material available to the full-time staff is more abundant than appears. Whether the present arrangement will prove to be the entering wedge or whether the two systems will continue to coexist remains to be seen.

The endowment of clinical education in the full-time form calls for large sums—sums that could hardly be obtained, if their beneficiaries were simultaneously leading more or less

[37] Inbreeding is unlikely to occur in the units for several reasons: (1) the person next in line may not be inclined to accept a full-time appointment; (2) he may be unacceptable to the university; (3) the head of the unit is bound to seek competent aids from the field at large.

lucrative professional careers. But the full-time system is not to be primarily regarded as a means of separating modestly paid teaching from well paid practice. That is, after all, a negative, and might be a sterile procedure. It is rather the tardy recognition of the fact that clinicians aspire to be scientists; that, like other sciences, medicine cannot be successfully prosecuted, unless its votaries are enabled to devote their time and energy to painstaking study and experimentation, wide reading in many languages, discursive conversation, and leisurely reflection. Of the multitudinous problems in medicine pressing for solution, some must be attacked in the pre-clinical laboratories, some in the wards, others in the wards and the ward laboratories. Assuredly conditions, essential to the cultivation of the laboratory subjects, cannot be irrelevant to medicine, which is far more difficult and intricate than any of them. For the physician deals with the most complicated of mechanisms—the human body; he must be master of a vast and rapidly increasing volume of knowledge, into which streams from a thousand sources—foreign and domestic—continuously pour; must—spare himself as he will—spend himself in human ways, as no physicist, astronomer, or philologian need; must administer an elaborate and costly organization which will function effectively only if constantly tended; finally, he must teach and somehow supervise the teaching of others. Under these circumstances, full time itself is sadly inadequate to the opportunities for service—human, educational, and scientific—afforded by a medical clinic.[38]

[38] The full-time teacher in professional university departments has perhaps most strongly entrenched himself in the law school, of which the Harvard Law School was the first, and is perhaps still, the most highly developed type. Law is probably somewhat less exacting than internal medicine; but, however that may be, the inadequacy of full time to the university professor of law is very convincingly set forth in a note by Professor Ezra Ripley Thayer, printed in the Harvard Law Review, January, 1912, pp. 269-273. I quote a few sentences, as applicable to medicine as to law: "Suppose that the teacher is a scholar. . . . In the first place his spare time may not be so great a matter, after all. The mere preparation for his classroom work will be a large matter. Teaching law, if fitly

It is obvious that, free as the full-time clinician is to do what he chooses, he will, as a matter of fact, almost wholly confine himself to work in the wards and out-patient department if for no other reason than that he will find there more than he can do. He might, however, fail in some part of his opportunities if he and his immediate associates themselves assumed complete and sole responsibility for the current conduct of the clinic and the out-patient department. Most full-time departments, as has already been pointed out, therefore include a group of part-time men who participate each as he is best fitted to do in the care of patients and in teaching; indeed, from the standpoint of both teaching and hospital management there are certain things involving speed and skill—the teaching of physical diagnosis, fractures, and abdominal surgery—which may be better done by men in active practice than by men who are intensively concerned with problems. The student thus obtains the benefit of a miscellaneous or special clinical experience, whether that be great or small; the patient obtains help that may lie beyond the field of interest of any member of the full-time group; and men, interested in investigation, yet indisposed or unable to lead completely academic careers, may still find ways of making their contribution to knowledge. Moreover, passage from one group to the other may readily take place as temperament and developing abilities may dictate. Thus the full-time plan involves no risk of narrowness to patient or student, while for the full-time worker it preserves the severe and simple conditions essential to elaborate and arduous research. Inasmuch as no person can do

performed, calls for an amount of time, thought and attention which instructors can seldom give. So the spare time is already contracting. Such as it is, how will it be best occupied? First and foremost comes the attempt to make himself a master of the subject which he teaches. This is a vast enterprise and he is fortunate if in a lifetime he can complete the study of a single subject. If he can, other subjects will supply him with more worlds than he has time to conquer. And so his spare time has already disappeared. What remains is only an unending struggle to decide which of many things that call to be done shall be sacrificed to the next." (Abridged.)

everything, any possible course involves a loss; but the full-time teacher presumably makes what is, for one in his position, on the whole the least loss and the largest gain.

In the preceding chapter, I endeavored to show that, logically, medicine is capable of being regarded as a science. The full-time scheme puts this conception to a very practical test. Will medicine enlist in its service as devoted, enthusiastic, and self-forgetful workers as have been absolutely essential to the development of other sciences? Or will physicians and surgeons crave conditions that the university cannot create or maintain? There is no need to answer the question at this moment. Full time has created some problems, while solving others. It may, however, be conservatively stated that an encouraging start has been made, although the experiment cannot be regarded as complete. Yet on its issue depends largely the question as to whether or not medicine and surgery will be attacked by the concentrated resources of modern science which are yielding such notable results in the pre-clinical, as in other, sciences.

In addition to the strict scheme just described, the term "full time" is currently applied to certain modified types of organization. It is, for example, used to characterize clinical teachers, who, though engaged in practice, merely concentrate their work—private and academic—in the hospital in which their teaching is done. Thus they avoid the loss of time and energy involved in visiting homes; but it does not necessarily follow that their activities and way of life are truly professorial. At Toronto, a time division is made: the day, say up to four in the afternoon, is devoted to the university, while the hours from four to six are reserved for private consultations—an arrangement difficult to preserve, especially in case of the surgeon. Again, a few beds in the private pavilion may be reserved for each member of the "full-time" staff. Finally, in the absence of a definite limitation, a "gentleman's agreement" may exist to the effect that private and consulting practice will be so restricted that it will not be permitted to interfere with professorial obligations—in which event, however, it is

not clear how the line is to be drawn or the understanding enforced.

In its rigid form, the full-time scheme is decidedly expensive:[39] will the expense be justified by the superior care of patients, the superior instruction of students, the increased productivity of the staff? Everything depends on the type of person that the full-time arrangement attracts. If medicine be indeed a science, actually or in process of becoming, it should attract the higher types of intellect, precisely as physics and astronomy attract them; it should be no more disturbed by practice, than is mathematical physics disturbed by the opportunities of the electrical industry, geology by the oil industry, or chemistry by the dye industry. The variations above described are decidedly less expensive; will they accomplish the end as well? As to this, time alone can decide. The danger is obvious—namely, that practice will encroach. The indefiniteness of the "gentleman's agreement" may be of little moment as long as only a few persons are involved—as is at present the case. It remains, however, to be seen whether it will operate effectively when several departments, involving many persons, are so organized, or whether it is readily capable of being reproduced in one institution after another. Undoubtedly, however, the existence of institutions which adhere to the strictest possible formulation will tend to stiffen those which are less explicitly defined and will in time make possible a comparative judgment on the merits of different types of organization. It is perhaps worth noting that the objection to the rigid full-time scheme on the ground that men resent a prescribed limitation lies also against all the modifications of the full-time scheme; for a limitation does not cease to be a limitation, if "no paid private practice" becomes through definite arrangement with the university authorities "a few beds" or "a gentleman's agreement." Explicit limitation of beds or a gentleman's agreement is also an abridgement of the individual's liberty to do as he pleases, though psychologically there may be,

[39] See pp. 305-6, 310, 322.

to some temperaments, a difference. Perhaps, however, objection on this score would vanish, if the full-time scheme were described, as it should be, not as an abridgement of liberty, but as a permanent and effective protection against distraction in the interest of conditions desired by the scientist for the pursuit of his own highest ends; for as such—as a protection and not as a restriction—it is regarded by those who are now conducting full-time clinics in America and England.[40]

One point more should be emphasized. I have in this chapter discussed different types of medical schools. Undoubtedly, the general type to which a school belongs is profoundly significant. The type recognizes, encourages, and prizes certain kinds of activity and interest; but activity and enthusiasm are, of course, the important factors. They may accomplish high ends despite the prevailing type; no type—university, full-time, or other—will accomplish high ends without them. Organization is valuable to the extent that it facilitates good work; it is worse than worthless if it becomes complex, expensive, formal, bureaucratic. The German organization was, on the whole, in its best days, enormously valuable, because it was flexible and stimulating; it provided conditions favorable to work; it energized and trained mediocrity beyond its natural level. At the same period, French, English, and American organizations were poor, because they interposed obstacles to productive work and to excellent training. On the other hand, there is no magic in organization as such. A full-time organization will not transform a sterile clinician into a proper uni-

[40] It is at times urged that the university should not treat the professor of medicine differently from the professor of Greek. But in respect to history, experience and, most of all, situation, the two *are* different. If the professor of Greek were as exposed to outside pressure as the professor of medicine, if he required so great a budget, if, finally, Greek had had, academically, the same history as clinical medicine, the university might, in order at once to create an entirely new organization and spirit, find it advantageous to come to a definite understanding with the professor of Greek; and professors of Greek might seek the understanding, precisely because it is the surest and quickest way to recognize and establish the new order, and to obtain for it the unprecedented support required.

versity professor. A sound organization can succeed only in so far as it attracts able and enthusiastic workers and enables them to be effective. Moreover, in every country individuals belie the type. There have been productive clinicians in the practical clinical schools of France and England; there are unproductive clinicians in the university schools of Germany and the United States. The full-time scheme is designed to lighten the burdens and to increase the efficiency of the clinician, his helpers, and his students; but it will not produce ability and enthusiasm where they do not exist; it will not make the sterile clinician fertile, and meanwhile really determined and fertile minds will continue to produce on part time or almost no time at all. None the less, it remains true that systems, though never alone decisive, are as such important, inasmuch as the ideals they embody and the conditions they set up tend either to promote, depress, or dissipate effort.

CHAPTER III

GENERAL EDUCATION

I

Medical education cannot be described or discussed apart from general education. The maturity, previous training, and intellectual competency of the student body determine in advance the scope, quality, method, aims, and outcome of the instruction offered by the medical faculty.

Elementary and secondary education should, of course, be conceived from the standpoint of the pupil as human being, not as future doctor, artist, or engineer. As far as possible into adolescence, all children are assuredly entitled to the untrammeled development of their faculties, in order that, to the extent of their capacity and irrespective of social and economic accident, they may participate in the enjoyment of the cultural heritage of humanity. This is best for them as persons; in the long run it is also best for them as breadwinners. The social loss is more lamentable than the individual's own loss, if the development of an able youth is frustrated for no better reason than that he comes of "the wrong people." On the other hand, a serious and general social loss is also incurred, if superior opportunities are lavished upon the stupid or indolent, for no better reason than that they are of "the right sort." Higher education needs to be broad in purpose, easily accessible, and if it is to be really efficient, open on the basis of ability and earnestness.

No nation has yet fully organized its educational system in this fashion. In many European countries even the elementary schools make a distinction between children who are not, and

children who are, expected to get a fairly free chance to develop; the former enter an educational blind alley, out of which they struggle into trade, a factory, or agriculture; the latter follow the broad highway into the universities and the higher technical schools; only occasionally do bright students climb over the fence that separates the two groups. The American theory is sounder. The same quality of education—elementary and secondary—is open on equal terms to all pupils alike, even though the sacrifices made by the parents remain very uneven, and educational facilities are, as we shall see, far from homogeneous throughout the country.

There are, however, indications of a movement in Europe towards the breaking down of the custom of restricting or limiting educational opportunities more or less according to social and economic distinctions. The first German school law adopted after the recent revolution ordered the suspension, not later than 1930, of the special preparatory schools hitherto maintained for the well-born and the well-to-do, and consolidated the education of all children up to the tenth year. In Sweden, secondary school fees are so inconsiderable, that the children of peasants and artisans attend the *Gymnasia* and subsequently enter the universities, which—as is also the case in Denmark—are free. In Holland, the burgher school, relatively popular in character, has recently won equality before the law with the more conservative and aristocratic *Gymnasium*; while in England, the Labor Party and advanced Liberals have made free and general secondary education the cardinal feature of an educational program.

The outstanding reforms in education during the last half century consist in enlargement of scope, in adaptation to individual and social needs, in the development of sense and muscle training at the expense of purely formal studies, and in emphasis upon inductive thinking. Whether one considers appreciation, enjoyment, or use, education, under the bookish tradition, was too much intellectualized, making far too little of the body and the senses. Sense perception, experiment, and inference

have an important and increasing part to play in general education—and from its very start in the kindergarten or the elementary school; they play an even larger rôle in the training of those who incline to scientific studies. Their *general* importance to the individual and to society gives them a place in the education of all children; their *special* importance to those who expect to make a career in science warrants increasing emphasis as the student passes through the secondary period.

But modern educational theory does not countenance mere sense-training or merely inductive thinking. It is entirely feasible to devise a balanced ration, containing literature, history, music, and art as well as mathematics, science, and games. The schedules of the elementary school are everywhere now of this character; but the spirit of instruction and the content of the textbooks are still in general excessively formal and abstract. Though the curriculum has been enriched, it is still the exceptional school in which the child actually leads a normal and wholesome life—his interests awakened, his enthusiasm kindled, his powers of intellectual application challenged and disciplined.

In so far as secondary education is concerned, all countries now set up at least two general types of instruction—the humanistic and the scientific—some subjects being common to both. In either case, general education—not specialized education and not vocational education—continues to be the aim. But it has come to be universally recognized that general education is entirely compatible with recognition of individual differences. The day has passed when the secondary schools could set up a single goal, to be reached by a single pathway, trodden by all alike. In adolescence—sometimes earlier—permanent and significant tendencies are apt to disclose themselves. It is indeed the business of the school, and especially of the secondary school, to uncover native bent and to direct it sanely to fruitful purpose. To the student of medicine, in whom we are particularly interested, these indications are of enormous

importance. They must not lead to premature specialization; a short-sighted effort to realize immediate returns is to be deprecated. But, on the other hand, these signs must not be ignored or suppressed. On the contrary, they require increasing consideration and opportunity.

II

The medical school on the continent is in name and in fact part of the university [1]—a state institution—into which there leads only a single path—the state-regulated and state-controlled secondary school.[2] This secondary school was on the continent originally under the supervision of the Church. The priest, minister, or clerk was the teacher; ancient languages, mathematics, and philosophy formed the curriculum. Modern interests, i.e., science and spoken languages, began to assert their importance successfully during the last third of the nineteenth century. Gradually they edged their way into the secondary school; new types of secondary schools, at first subordinate, in course of time coördinate, were at length set up. But whatever the type—humanistic or modern—continental secondary schools are marked by certain common characteristics: they are usually class schools,[3] limited in number, predominantly intellectual in purpose, disciplinary in procedure, approximately uniform in respect to facilities and the competency of the teaching staff. European peoples differ markedly in social atti-

[1] The medical school at Stockholm, known as the Karolinska Institutet, though standing alone is only an apparent exception; it is to be regarded as the first faculty of a university which remains to be completed. It has nothing in common with the independent or proprietary medical schools of England and America.

[2] Private schools exist, but they conform to state regulations.

[3] Fees are charged—sometimes heavy, in comparison with the income of an ordinary family. In Germany scholarships support about 10% of the pupils; in England scholarships, free places, and maintenance grants, and in Scotland bursaries and scholarships provide for about 30%. In Scandinavia fees are practically nominal.

tude: Germany and France, whatever their form of government may be called and whatever individual exceptions may be cited, are middle class aristocracies; Switzerland, Denmark, Sweden, and Scotland are in varying degrees democratic. But deep-seated social and political differences have not in Europe thus far seriously influenced popular attitude towards the secondary schools. Though these schools are freely criticised because their curricula are too narrow, their methods too mechanical, their attitude too unsympathetic, they are not asked to abandon their intellectual standards or to modify their intellectual aims for the purpose of doing something entirely different for those unable or indisposed to maintain themselves in them. Other forms of educational opportunity are in process of creation and extension for boys and girls who are intellectually and socially handicapped, or who are, in point of ambition, indifferent. But the *lycée* and the *Gymnasium* [4] in all continental countries maintain their intellectual and social distinction, and, despite the growth in democratic and humanitarian sentiment, continue the one portal to the universities. Democratic Scandinavia and democratic Switzerland stand in this matter with France and Germany.[5] Boys of less than average ability and earnestness are, of course, found in the continental secondary school, but their road is increasingly rocky as they go on; and the mortality among them is heavy.[6]

[4] I use the term "*Gymnasium*" to include all schools of gymnasial rank —in Germany, for example, the *Gymnasium*, the *Realgymnasium*, and the *Ober-Realschule.*

[5] In Switzerland, students who have not been regularly graduated from a cantonal *Gymnasium* (the usual way of entering a university) may pass the Federal *Maturitätsexamen.* They are usually either foreigners, or persons whose regular studies have for one reason or another been interrupted. In the five-year period, 1918-1922, 477 such candidates were successful, of whom 123 were foreigners. The German revolution has produced a similar regulation for the benefit of those who have not received the usual gymnasial training. The Germans, realizing the necessity of a more democratic procedure, are also aware of the danger of letting down the bars. The scheme adopted is therefore a carefully guarded one: the applicant must pass an examination given by university teachers.

[6] In the Prussian *Gymnasium*, apparently about one third.

III

Three types of secondary school curricula now admit the German student to the university—the classical *Gymnasium*, emphasizing Latin and Greek, the *Realgymnasium*, emphasizing Latin, modern languages, and to some extent science, the *Ober-Realschule*, emphasizing modern languages, mathematics, and science. These schools are, in respect to facilities, equipment, and the competency of the teaching, practically uniform throughout Germany and Austria. Buildings and equipment are plain, substantial, and adequate for the type of instruction followed. The teachers are university graduates—competent scholars under the supervision of an experienced director. The teaching schedule fixes the subjects and the hours, but within this general organization leaves large freedom to the instructor.

Pupils enter the *Gymnasium* at nine or ten years of age, after spending three years in a preliminary preparatory school; the course in the *Gymnasium* is nine years in length. Though there are subjects common to them all—religion, history, and German, for example—the three types above mentioned were for several decades distinct throughout; latterly the reformed *Gymnasium*, with a common course running for several years, enables the student to defer his choice. Between 1890 and 1911, the attendance at the classical *Gymnasien* fell from 72 per cent. to 52 per cent. of the total; the attendance at the *Ober-Realschulen* rose from 4 per cent. to 25 per cent. The compromise school (the *Realgymnasium*) barely held its own (1890, 24 per cent.; 1911, 23 per cent.).[7]

The selection of his school once made, the student's subsequent opportunities for election are of minor importance. In general, then, it may be said that a German boy who wishes to enter the university to study medicine may select one out of three secondary curricula, all equally long and equally exacting. If he cannot maintain himself in a secondary school at a rela-

[7] The percentages for 1917 were as follows: *Gymnasium* 47%; *Realgymnasium* 30%; *Ober-Realschule* 23%.

tively high level of diligence and achievement, a career in medicine is closed to him; or, to put it somewhat differently, the study of medicine is limited to the fairly homogeneous group who have survived a severe nine-year secondary training. Should the student select the *Ober-Realschule,* which omits Latin altogether, he must somehow procure training in Latin before matriculating in the medical faculty. For the relief of those who had participated in the war this requirement was temporarily waived. Recently the government has raised with the faculties the question as to whether the Latin requirement should be reinstated in full force. The response was overwhelmingly in the affirmative. Indeed, the veterinary faculties, which have not hitherto required Latin, denounced the absence of Latin from their curriculum as a defect, in consequence of which their students are unable to understand technical terms, and some of them even recommended a corresponding requirement in Greek.

IV

The *lycée* [8] in France is the equivalent of the German *Gymnasium.* The *lycée* is an essentially uniform institution, conducted everywhere by teachers of scholarly training and ideals. It differs from the *Gymnasium* mainly in the greater detail with which the program of studies is worked out; strict regulations laid down at the ministry are enforced by a staff of inspectors intent upon the letter of the law. But the differences go further: modern subjects have been introduced into the curriculum more recently in France than elsewhere on the continent, and, as we shall shortly perceive, their place is less secure; moreover, to a quite unprecedented extent, the French schoolmaster insists upon precision in speech, exactness in statement, and elegance of form—qualities which appear almost as strikingly in

[8] The *lycée* and the *collège* need not, for our purposes, be separated; the *lycée* is conducted by the state, the *collège* by the commune, city, or even by a private organization, under state surveillance.

the utterance of a student undergoing an oral competition as in a set professorial address on a formal occasion.

After a bitter struggle, the French reached in 1902 a somewhat more radical solution of the contest between the classics and modern science than was attained in Germany, where between the classical *Gymnasium* with Latin and Greek, and the *Ober-Realschule*, lacking both, the *Realgymnasium*, occupying middle ground, contains Latin, modern languages, and science. For the two baccalaureate degrees, one classical, the other scientific, the French in 1902 substituted a single degree in acknowledgment of the equal cultural and disciplinary value of the two definite secondary courses—the one humanistic, the other scientific. The decree, embodying the reform, outlined an eleven-year course of study—four years of elementary work, followed by seven years of secondary work, divided into two successive cycles, respectively four and three years in length. The first cycle, running four years, gave the student a choice between a classical course and a course based on French and other modern languages. The second cycle, comprising the last three years, offered four courses—Latin and Greek, Latin and modern languages, Latin and science, and finally, science and modern languages. Thus in France, as in other continental countries, the student could enter the university and begin the study of medicine on the basis of an education mainly classical, an education mainly modern, or a compromise including both.

In January, 1921, M. Léon Bérard, Minister of Public Instruction, urged upon the *Conseil Supérieur de l'Instruction Publique*,[9] a modification of the arrangement adopted in 1902 to the end that Latin might be required of all students for four years and Greek for two. The *Conseil*, withholding an unqualified approval of the reforms of 1902, declined to endorse M. Bérard's proposed reorganization. None the less, by presidential decree, M. Bérard's reforms were made into law.

[9] An advisory body, consisting of five Academicians, nine educators at large, eighteen professors representing higher education, ten representing secondary education, six primary teachers, and four teachers in private schools.

As matters now stand,[10] every secondary student in France, beginning October 1, 1923, will have at least four years of Latin and two of Greek, while all students throughout the entire course will receive identical training in science; students who drop Latin and Greek at the end of the periods respectively required will take up French and another modern language.[11] In behalf of this step, which confines secondary education in France to the narrowest limits of choice that obtain in the western world, it is argued with justice that the culture of France is distinctly Græco-Roman; on the other hand, such a settlement, made, as the present settlement was made, in a political, if not yet a social, democracy, is hardly likely to go for long unquestioned in an age of industrial, scientific, and social progress.

In French teaching two points are strongly emphasized—facility in expression, oral and written, and severe application to specific tasks. The French student learns to apply himself, to speak, and to write. Thus the *lycée,* like the *Gymnasium,* is concerned to train and equip the minds of the able and industrious, though—be it also noted—the range of alternatives is great enough to include other activities, which give scope to trained intelligence. Promotion from class to class is made with more or less leniency; but the baccalaureate examination is remorseless, and therefore of definite and quite uniform significance. For a period of seven years (1902-1908, inclusive), 46 per cent. of those examined for the baccalaureate failed.[12] Inasmuch as only those who pass are eligible to the university, it

[10] July, 1924.

[11] A full account of the controversy is given in M. Léon Bérard's *Pour la Réforme Classique de l'Enseignement Secondaire* (Paris, 1923). For a temperate summary, see A. A. Méras: *The Eternal Controversy in French Secondary Education.* (Teachers College Record, November, 1923.) The controversy is not yet closed; as this volume goes to press, a change in the ministry is accompanied by the announcement that M. Bérard's decree may be modified in the direction of the reform of 1902.

[12] F. E. Farrington: *French Secondary Schools* (New York, 1910), p. 46. It is to be remembered, however, that students are permitted a second and a third trial.

is evident that French students of medicine are, intellectually, a highly selected and well-seasoned group.

V

Differences in organization exist between the French and German schemes on the one hand, and those of other continental countries on the other, but they are, from the standpoint of our present inquiry, of minor importance; for everywhere on the continent the secondary school is a selective institution, by no means inelastic, but always severe; the teachers are trained scholars, highly esteemed, education is seriously regarded, and school success is the passport to social prestige and to professional and official standing. The tone of social life in Switzerland, Holland, and Scandinavia is distinctly more democratic than in France and Germany; and secondary school fees are lower. But there is no weakening in the matter of intellectual standards. It is interesting, also, to note that the increasing popularity of modern studies has not reduced the demand upon the student. The continental teacher on the modern side is as stringent as his brother teacher on the classical side.

The more democratic complexion of Swedish society is exhibited in the common school basis—a five-year course devoted mainly to modern languages, elementary science, geography, and mathematics. With the sixth school year, three options are allowed to the prospective university student, of which two—the Latin *Gymnasium* and the *Realgymnasium*, each four years in length—concern the student of medicine. The former emphasizes Latin—Greek is optional—without, however, omitting French, German, English, or science; the latter omits both Latin and Greek and increases the time allowance for mathematics, modern languages, and the sciences. Thus, the Swedish boy may enter the university and study medicine without knowledge of Latin.

For our purposes, Denmark may be classed with Sweden. A

common basis is provided by the folk-schools up to the eleventh year of age, which themselves continue up to the fourteenth year. At eleven, however, pupils intending to go into business and the universities are diverted to the middle school with its four-year course, at the close of which the prospective university student enters the three-year *Gymnasium*. Differentiation at two points, scholarly teaching and long traditions, which sanction severe work, produce in democratic Denmark substantially the same type of competency that one may observe elsewhere in Western Europe. Up to the middle school, practically a single course is pursued by all pupils; within the three-year *Gymnasium*, three courses are offered—the classical, strongly emphasizing Latin and Greek, and omitting the sciences altogether; the modern language, including Latin (only slightly reduced in amount) and the elements of the sciences; the mathematical-scientific, without Greek or Latin, and heavily loaded with the subjects by which the course is designated. In respect to the quality of teaching and the severity of the demand upon the student, there is no difference whatever. As in Germany, the medical student who elects the mathematical-scientific group is compelled to acquire some Latin independently.

In Holland, the higher burgher school, offering neither Greek nor Latin, is far more popular than the *Gymnasium*, which is the most conservative secondary school in Western Europe,[13] partly, perhaps, because the gymnasial course is six years in length, that of the burgher school only five. The university admits the graduates of both; but up to 1920, the burgher school student could not obtain the degree of M.D. unless he made up the deficiency in Latin. He could become a physician, even a professor in the faculty, but not technically "doctor." A recent enactment has now removed this disability. The Dutch boy, like the Swedish boy, but unlike the German and the Danish, may complete his medical education in the university without Latin.

[13] In 1920 there were 3,526 students in public *Gymnasien* and perhaps 2,000 more in private *Gymnasien*, as against 16,453 in burgher schools, public and private.

All alike are admitted to the university without formality on the basis of the secondary school leaving certificate; nay, more, these certificates pass current at face value throughout Western Europe. The universities of every country, themselves state-controlled, know that the graduates of the state-controlled secondary school of the continent form a competent and homogeneous student body; and inasmuch as they also know this of one another, the Swedish or Danish "gymnasiast," as he is called, is free to enter a German or Swiss university, and vice versa.[14]

VI

A distinctly different picture is presented by both Great Britain and America. The uniformity, definiteness, and scholarly quality of secondary education throughout Western Europe—always state-controlled and mostly state-supported—contrast sharply with the unevenness of Great Britain and the laxity widely characteristic of America.

Three types of secondary school may be distinguished in England: (1) a class composed of the historic public schools and a very much larger number of endowed grammar schools—at present numbering altogether considerably above one hundred; (2) secondary schools of divergent origin—some religious, some municipal, some proprietary—which, under the steady pressure of a series of Parliamentary and administrative enactments beginning in 1902, are gradually being welded into a national system of secondary education; (3) private schools, representing every grade of merit from slight up to good and, in a few instances, excellent. This rough classification indicates that on crossing the channel secondary education ceases to represent an approximately uniform educational process and result, though various forces—government inspection, grants, common examinations, definite requirements in teacher training—are

[14] But in Sweden foreigners cannot receive the medical degree, entitling them to practise, without governmental permission—practically unobtainable.

slowly bringing about a measurable degree of order. The so-called public schools, which educate a very large part of the socially and economically advantaged youth of the nation protect themselves against interference on the part of either the state or the universities.[15] They jealously cultivate a definite type—moral, physical, social, and intellectual. The heads are generally clergymen—able administrators and excellent classical scholars[16]—who are prominent figures in public as in school and church life. Not infrequently a public school headship leads late in life to a bishopric, a deanery, or the principalship of a Cambridge or Oxford college. The masters are Cambridge and Oxford men who have, as a rule, achieved distinction in scholarship and, if they are doubly fortunate, in athletics; many of them—though a diminishing proportion—have taken orders in the Established Church. Inasmuch as their educational life represents a circle—a public school, Oxford or Cambridge, and back to a public school—the staff is as a rule highly conventional in educational outlook. But progressive and disturbing personalities, of whom the late Edward Bowen, who established the "Modern Side" at Harrow, is an excellent example, are not entirely unknown.

The curriculum of the public school has passed through the same stages as the secondary curriculum on the continent. Bowen started the "Modern Side" at Harrow, raising with the headmaster, Dr. Butler, at the outset the question as to whether or not it was to be qualitatively equal to the classical side; he enforced the affirmative decision so successfully that in the course of a brief period, despite the social preference for the classical side, which, after half a century, still prevails, the modern boys made an excellent showing in competition for the coveted university prizes. At the present time the public schools with many individual variations offer what is equiva-

[15] Latterly, some of the public schools (e.g., Winchester) have invited government inspection, so as to get the benefit of official experience, but they avoid control of any kind by declining to accept a government grant.

[16] Occasionally a headmaster has been trained in science—e.g., Sanderson of Oundle.

lent to three overlapping courses—classical, modern and engineering—corresponding in content to the three gymnasial types observable on the continent. The typical product of the English public school is first of all a "gentleman"—a sane, but conventional youth, with a high standard of personal honor and physical fitness, as a rule a definite consciousness of his own social and intellectual superiority, and slight or substantial scholarship in classics, mathematics or science, according as he has been groomed to be a "passman" or a "classman." The methods of teaching, especially those employed in the uppermost "forms," tend to throw the abler on their own responsibility, so that they possess a greater degree of self-reliance than the continental boy, or, as we shall see, the American boy. On the other hand, leaving the secondary school has, educationally, no definite meaning. Indifferent students are tolerated, drilled, and ultimately, if their parents so desire, carried to the university,[17] where, as "passmen," they lead pleasant rather than studious lives. The well-endowed and ambitious are highly coached; though the prig is detested, and good form requires even the serious student to conform to conventional standards of behavior, the school is proud of competitive intellectual achievement. Boys of caliber usually tarry at school a year or two beyond the time when they might enter Oxford and Cambridge—partly because the life is pleasant, partly because the masters like to retain them as a wholesome influence over the younger boys, partly because they are apt to bring athletic credit, partly in order that they may enter the university with riper scholarship. The members of this group are marked and stimulated by a steady series of prizes and scholarships; they become honor men, prize men, fellows, etc., at the university. Selection culminating at the top reaches in this way deep down into the secondary school. The leaving students of the English public schools are thus as a body intel-

[17] University training is not yet regarded as a business, though it is an important social, asset. Hence the proportion of secondary school graduates who enter the university is much below that in the United States.

lectually far less homogeneous than the output of the continental *Gymnasien,* but the best are excellent in scholarship, though not usually aggressive or original, and faultless in manners.

Prospective students of medicine, who go to Oxford and Cambridge—usually, as we shall see, taking also an academic degree in one of the medical sciences—are subjected to still further sifting. They may enter their first examinations at the end of two years; the candidate for honors may not defer his final examinations beyond three years. The universities thus institute a definite competition with a time limit for the purpose of selecting the best men; only those who win, making a "first-class," have an opportunity for a scientific or academic career. Unconventional workers are thus doubtless lost to science and the universities. The system is therefore formal and inelastic; but it has the great advantage that really severe intellectual application at definite points, in England as in France,[18] picks out a group of exceptional men, whom the social system of the universities holds together and cultivates. For, at its core, the ancient English university consists of a relatively small and close group made up of master, fellows, and honor students.

The comprehensive system of secondary schools, first urged by Matthew Arnold on the basis of the German program of his day, is still far from realized in Great Britain, though the chaotic conditions, long existing, may now be described as clearing up. Through grants in aid, the national authorities have step by step forced the improvement of school conditions. The best of the secondary schools maintained by the large municipalities reach a high level of excellence. Indeed, at a recent scholarship examination held at Cambridge—once a public school monopoly—the public schools won fewer scholarships than the council and other state-aided grammar schools; even some of the Trinity scholarships—the blue ribbon—were won by the latter.[19] On the other hand, these schools are as yet

[18] In France in connection with the *internat*, see pp. 248 ff.

[19] The Cambridge Review, Jan. 14, 1921.

far from uniform. They still show a deplorably wide variation in all essential respects. The same may be said even more emphatically of the private schools, which vary from feeble commercial or sectarian enterprises to well-conducted, though narrow, preparatory schools. Inasmuch as leaving the secondary school is still an uncertain indication of scholarship, the universities conduct their own entrance examinations, which are far below the leaving certificate or baccalaureate standard of the continent. Indeed, while men entering the universities in the honors group are comparable in maturity to the continental university student, the entrance standard for passmen implies continuation in the university for a year or two of merely secondary school work.

VII

There is nothing in America that corresponds to the English schools, which make a frank distinction between the able and the indifferent student, the former continuing his training for the university far beyond the comparatively low minimum upon the basis of which the latter receives his perfunctory training. The endowed and the private secondary schools of the United States borrow from England a few external characteristics; their pupils come largely from the economically and socially advantaged; the instructors are sometimes known as masters and the principal is sometimes called headmaster. But a teaching career in these schools does not commonly enlist the well-trained and sometimes fine type of scholar often found in the English public or endowed school. Almost everywhere in America the curriculum of the boarding or preparatory school makes equal demands upon all; practically the entire student body completes the same course of training in the same length of time; the course in question begins and ends with the college entrance requirements—higher, to be sure, though also more diffuse, than the standard set for passmen by Oxford and Cambridge, but far below the attainment of the honors group.

Intellectual and scholarly emulation is assuredly not a characteristic feature of preparatory school life in this country.

The universal provision of free secondary education is now undertaken by all the states. Within the last two or three decades, four-year high schools have multiplied so rapidly that, in name and form at least, free secondary education of wide range in subject matter is generally accessible to American boys and girls. It goes without saying that so sudden a development could not be thoroughgoing. Satisfactory buildings and equipment and a more or less competent teaching staff—a considerable but diminishing proportion being men—are found in some large cities; but in respect to neither salary, educational opportunity nor dignity is the position of high school teacher or principal in America usually an attractive one. Nor does the internal organization of the schools favor the development of able and ambitious pupils. The course of study is four years for all alike; for the most part students accomplish the same tasks in the same time; too many distractions, some wholesome, others unwholesome, have been invented by both school and society as a substitute for continuity of mental effort. Under such circumstances the mediocre and the indifferent too frequently set the pace and determine the teaching method, with this result—that the American boy, self-reliant and independent outside the schoolroom, is mentally singularly helpless and immature. A sympathetic English critic wrote some fifteen years ago: "It is a felony, not to drink small beer, but to ask for stronger ale than most heads can stand. The ablest scholars . . . work on the same lines as the dunce and the idler, merely doing well what they do ill." [20] That, to foreign eyes, the situation still maintains this same general character, is suggested by the recent confirmation of Hill's impressions by a French observer: "Secondary teaching seems to me to be the weakest point of the American system of education. The student who comes out of the high school at eighteen has not had a suffi-

[20] G. Birkbeck Hill: *Harvard College by an Oxonian* (New York, 1906), p. 241.

cient intellectual training. . . . He often arrives, after leaving the high school, with considerable deficiencies even in the knowledge of English." [21] These unfavorable judgments of secondary education in the larger centers are accepted by candid American administrators.

In the small towns and rural districts, the high school is necessarily still more sketchy. High schools exist by the hundreds in small towns, villages, and the open country, in which a few under-prepared and over-worked teachers attempt to carry small groups of unselected and ill-taught boys and girls through a so-called high school program. Yet the graduates of these new-made high schools are, like the graduates of the more substantial urban high schools, admitted to the state university and to many endowed and privately managed colleges on the basis of certificates that witness practically only the accumulation, somehow or other, of a definite number of "credits" or "units of work," representing time spent rather than quality of performance.

The truth is that the American high school is expected to do several different things which are in conflict, with the result that the lower, rather than the higher, standard generally prevails. The high schools are, as I have said, free and accessible in city, town, and country. They are expected at one and the same time to train the better minds and to do what they can for the less gifted; and a false conception of democracy, not realizing that differentiation on the basis of talent is not only democratic, but the salvation of democracy, shrinks from any steps which would segregate the more able from the less able. It still remains true, none the less, that, education, intellectually viewed, involves selection, effort, and pressure, to none of which does America take willingly. For our present procedure it may, however, be said that an intellectually non-exacting, but socially and physically wholesome, way of living is provided for thousands of boys and girls who probably get more out of life and bring more into it, than would

[21] Maurice Caullery: loc. cit., pp. 66 and 138.

be the case if severe intellectual standards had in early youth eliminated them from the high school altogether. One should add that the confusion is for the moment further confounded by the multiplication of responsibilities laid upon the school; for the American home, for reasons that need not now be explained, makes the day school responsible for an ever-increasing share of the child's physical and social training.

A few American high schools have nevertheless attained a reputation for scholarship; and ambitious pupils sometimes reach a high level. The output is, however, too varied to be characterized in general terms. The graduate of an American four-year high school is at times able, earnest, scholarly; or he may be lacking in ability, earnestness, or scholarship; or he may belong at any one of an indefinite series of grades between these two limits. These graduates are, in general, eligible to college, after completing a certain *amount* of work—itself often enough merely nominal—with far too little reference to its quality. In consequence, the American college is called on to handle a huge unselected student body, the individual members of which differ too markedly in ability, education, and culture.[22]

VIII

Continental students, having completed the *Gymnasium* or *lycée,* enter the university and at once begin their medical studies. Within reasonable limits, therefore, they represent a homogeneous training; they are, as I have already said, a selected group, who have survived a rigorous and prolonged secondary school discipline. The subject matter of their studies may have varied considerably; some of them have had a modern, others—and this the larger, though a decreasing num-

[22] At the University of Toronto, the matriculation requirements for honors students are more severe than those for pass students, a year at least of additional preparatory work being requisite.

ber—a classical education; but all alike have been trained to take education seriously and all alike know how to work.

The English student is in a different position. He may, if a capable student in the sixth form [23] of a public school, complete his secondary education before entering the university; and having entered the university, he may take a degree in science in connection with the study of medicine. The students who pursue this leisurely course are relatively few in number, but they are indisputably important. There is a second group who, terminating their general education on leaving school, enter their medical studies at once on reaching the university; numerically the largest group begin their medical studies by passing the minimum matriculation examinations accepted by the General Medical Council—examinations which are far from requiring the student to complete a good secondary course of study.[24] To be sure, the students may be better educated than

[23] I.e., uppermost class.

[24] As a matter of fact, university matriculation or an examination accepted for matriculation became the minimum January 1, 1923; but the minimum university matriculation is far below the continental standard for entrance to the university. At Cambridge it does not necessarily require a modern language or science; at Edinburgh it does not necessarily require a modern language. In 1922, of 1,833 medical students registered by the General Medical Council, 1,283 were university matriculants, 531 presented recognized certificates of lower grade and 19 degrees in arts; of this same number (1,833), some go in for a degree (B.A.) in both arts (science) and medicine—thus extending, rather than changing, their course of study. Thus, at Glasgow out of an enrollment of 1,875 (on the basis of university matriculation) perhaps 20 are seeking a degree in arts or science, while working also for the medical qualification. At Edinburgh, over a period of six years (1910-1914 and 1922), 10% of the graduates also obtained the bachelor's degree, requiring a year or two of study in addition to what is required for the medical degree alone. At Oxford, all medical students must, and at Cambridge almost all do, obtain a degree, which, though called the arts degree, is usually made up of premedical subjects. A rare exception may win the arts degree otherwise (e.g., mathematics) and subsequently go into medicine or one of the medical sciences. In other words, the bachelor's degree won by the medical student is not usually a cultural degree, as that term is commonly understood, but a science degree, won by doing more than the medical curriculum would alone require in the medical sciences.

one would infer from the range of the minimum examinations. But it is still true that the British medical school body is a heterogeneous group. To make matters worse, all three grades of students above characterized may be found in practically every medical school. At Edinburgh, the English provincial universities, and the hospital schools of London, one may find side by side in laboratories and clinics students who took an arts degree before beginning or in connection with the study of medicine, students who went from the sixth form to medicine, and students who have passed the minimum examination accepted by the General Medical Council, viz., English, Latin, mathematics, and an additional language. As compared, therefore, with the relatively homogeneous student body characteristic of the continent, the student body of the British medical schools is a decidedly miscellaneous group. The medical faculty is therefore constrained to address its instruction to a varied and unassorted student body. We shall observe the way in which medical education in Great Britain is puzzled by this almost impossible problem.

The American boy completes his secondary education not at the high school, but at college; for, partly because the high school graduate is so often immature and inadequately trained, most American colleges are for two of the four years little more than secondary schools, very easy-going at that. Arrived at the end of his second college year, the American boy may begin his medical studies; [25] an increasing percentage, however, continue at college two years longer and begin medicine after obtaining a degree in arts or science. Externally the student body thus appears more or less homogeneous; for it is composed of students who have had at least two years of college work. But the uniformity is misleading, for the colleges are still, as I have pointed out, when taken in the mass, uneven and lenient; at times they are positively childish. They accept the uneven material that comes to them from the high schools; they are unexacting, like the high schools; they value a

[25] A few require three years of college work or a bachelor's degree.

good fellow more highly than a good scholar. Like the high schools, they too often "teach the pupils to be lazy." Able and industrious students may and do sometimes go far; but the rank and file vary far too much in point of ability, and are more or less industrious, as they please. I have said the same of Oxford and Cambridge; Oxford and Cambridge, however, gently but firmly edge the indifferent student to one side. No such differentiation takes place in the American college. The American *summa cum laude* leaves both the student body and the general public cold. Hence, the diploma or the certificate presented by the college student does not convey definite information as to his training, his knowledge, his ability, and his industry. Apparently, the medical schools of the United States stand on approximately the same educational plane; actually, the appearance is illusory, since the years of work and the credits witnessed by the certificates are infinitely various in educational significance. Meanwhile, unlike the English medical schools, the best American schools go behind the face of the papers. They ask the source of the credits, and thus, by dint of selection guided by experience, assemble, as far as they can, a somewhat more homogeneous student body, though, in my opinion, even in these cases, the student body is distinctly below the level which it appears to have reached. The truth is that, until high school and college do their job better, the medical school cannot find a homogeneous group at the proper level.

To make the situation even more difficult, the American medical school that rigidly enforced its declared standards of admission, really exacting high scholarship in the field of general education, might exclude some of the best material obtainable. The high schools and colleges necessarily attended by many American boys and girls simply cannot give an efficient training. This is particularly true, as I have pointed out, in less thickly settled areas. Under these circumstances, intelligence and industry tests, if such were feasible, would throw more light on the student's fitness than is now obtainable from his certificates and diplomas. In any event, the American medi-

cal school must itself appraise the student's abilities and initiate him into the mysteries of severe and self-reliant intellectual effort.[26]

IX

Not without significance is the manner in which the student passes from the secondary school to the university. I have pointed out that on the continent university and secondary school are both state-controlled; they belong in effect to one system. The student therefore passes as naturally from the secondary school into the university as he passes from class to class in the secondary school itself. On the other hand, the close of his secondary career is a notable moment. The examinations in Germany are conducted at and by the school with great formality in the presence of governmental representatives. They are serious affairs, lasting several days, and involving, as a rule, both written and oral tests—the latter a detail of immense importance. The state wants to find out whether the student possesses the capacity and training requisite for advanced study; the examinations are directed therefore to the student's general culture and general ability; they test his power as well as his knowledge. The examiners are expressly warned to avoid tests for which skillful "coaching" might avail; they are enjoined to block "tumultuous special preparation" in favor of "total cultivation," "lasting essential training"—

[26] I am not unaware of the difficulty and danger involved in making the generalizations to which so brief a summary of so large a topic must be confined. Yet I feel quite secure as to the objective fairness of the conclusions above stated. They could, if space permitted, be buttressed by evidence and the opinions of many observers. I venture to quote a single one from a source entitled to great weight—a professor, by the way, in a great American medical school, who studied for years in Europe: "It has been a matter of constant surprise to me to find that there are men who have had first class opportunities throughout their years of preparatory school and college and who bring so little in the way of fundamental and accurate knowledge to the medical school. I venture to think that this happens more often in the United States than in European countries."

A test in modern languages appears to sustain the view above presented. See pp. 101-2, and note 12.

precisely the opposite—as we shall see—of what commonly happens in Great Britain, and quite generally in the United States, where examination on minutely specified sections, for which cramming pays, is in vogue. This circumstance alone, all other things being equal—as they are not—would account for the superiority of continental secondary training.

In England and America, the secondary schools being so uneven, colleges and universities seek through their own machinery to measure the fitness of candidates. A dozen boards exist in England for the purpose; in the United States, the situation is very confused. Certain colleges and universities, especially in the eastern states, either conduct their own examinations, or, better still, accept the results of a coöperative body known as the College Entrance Examination Board. Examinations of this kind represent the best American practice; yet they serve their purpose unsatisfactorily, for they often hamper the good teacher, while enabling the dullard or idler to circumvent the examination by means of the skilled coach. Thus, in both England and America, tutors and cramming enable essentially uneducated boys to go through the motions that are supposed to indicate education; and in England, especially, an excessive competition for distinctions tends to make students content to master what is known, rather than to fire them with zeal for wider knowledge. In the southern, central, and western sections of the United States, certification by the school has practically replaced examination. Thus, as I have pointed out, students gain admission to college—as, indeed, they too often gain college degrees—by accumulating time-and-quantity credits—a kind of bookkeeping that has no relation whatever to education. As a matter of fact, no system of examination, inspection, or certification will make a poor school do good work. The schools must themselves be sound.[27]

[27] "*Perverse studet qui examinibus studet*" was a favorite saying of Wolf's. Quoted by Matthew Arnold: *Higher Schools and Universities in Germany* (London, 1882), p. 55.

X

Severe critics of the national educational system are nowadays found in all countries; it is apt to be the foreigner who, perhaps not unaware of defects, is keenly appreciative of merits. Benson is, for example, quite correct when he objects to the typical English schoolboy as conventional, unoriginal, pattern-made;[28] the continental objectors are sound when they object to the gymnasial discipline as too unbending, its instruction as too formal and pedantic, its social tone as, on the whole, bourgeois, if not aristocratic; nor are these blemishes of slight importance. It is something to be able to retort, as the American can, that, aside from a few private preparatory schools, which are exotic, the American high school aims to be sensible and comradely in discipline, flexible in curriculum, informal in method, and democratic in spirit.

There is, however, another side. Modern society depends for its effective functioning on expert service. The present volume deals with a single field—medicine; but what is true of medicine is true in a dozen other fields. Each requires its own technical discipline; but, more and more, it is obvious that professional training may be seriously crippled for the lack of a proper underpinning. Medical education on a modern basis cannot be imparted to everybody; it can be successfully imparted only to persons of good native intelligence, trained to serious application. Secondary education has many legitimate objects; but it cannot be held to have discharged its particular object in preparation for the study of medicine, as in a dozen other similar fields, unless it selects a competent group and trains them appropriately. The continental secondary school, whatever its defects, does at least measurably accomplish this task; the English achieve it with a small but definite group; the American high school and college are non-selective and too often postpone severe training until the student reaches the professional school itself. If we can imagine different na-

[28] See *The Upton Letters,* and *From a College Window,* passim.

tions grouping their beginners in medicine on the threshold of the medical school, the continental group would be most nearly homogeneous in age and trained capacity; the English group, taken in the mass, would represent the widest spread in years and maturity; the American group would represent the greatest differences in ability, discipline, knowledge, and fitness.

It is impossible in the course of a brief chapter to exhibit all the salient points of so large a subject as secondary education in many countries. Obviously, under modern conditions, the secondary schools have important functions to perform in addition to training students for special university studies. It is, however, entirely pertinent to inquire, as I have inquired, how well they discharge a particular function—in this instance, preparation for the study of medicine.

Reviewing the situation, one cannot escape the conviction that in all countries secondary education requires overhauling and readjustment. On the continent, the secondary school is too inflexible, too formal; the elimination of obsolete teaching material proceeds too slowly; tradition is too strong; too little is made of the normal child's interests and capacities. In England and America, there is, on the other hand, insufficient belief in intellectual quality. The continental does really believe in education, in the sense of selection and training; English faith in education as an intellectual discipline rather than a social opportunity is slowly growing; but in America, with childlike and universal acceptance of the importance of literacy, as distinguished from illiteracy, there is far too little appreciation of intellectual distinction and selection, and far too little intellectual leadership on the part of institutions devoted to learning. The world urgently needs a critical and comparative study of secondary education in reference especially to professional and other higher training, as a basis for school and university reorganization.

Meanwhile, on general grounds, nowhere is a vigorous secondary school so important as in recently settled countries; for these countries must, among other things, look to their

schools to make good the defects of their cultural background. The war rocked Europe to its very foundations; it destroyed men, money and forms of government; it released social forces with results that cannot yet be predicted; but there is nothing to show that it vitiated the scale of values, or impaired the cultural treasures, of the old world: the former secures educational standards, the latter richly supplement the work of the schools. America possesses as yet neither definite educational standards nor large cultural resources. There is no reason to wonder or to complain that such is the case; all the more important, however, to realize and drive home the fact.

CHAPTER IV

THE BASIC SCIENCES; MODERN LANGUAGES

I

The physician should first of all be an educated man; that is required by his position in the community and his relations to the patient and the patient's family. As we have observed, the continental nations take care of this point. There is a strong presumption that the youth who has attained the baccalaureate in France or has won his leaving certificate in Germany, Switzerland, Denmark, or Sweden is respectably educated, in the technical sense of the term. And his school training is supplemented by what he inevitably gains from the rich cultural setting in which his life is cast.

In Great Britain, the situation is very different. The sixth-form prize man who goes in for an honors degree at Oxford, Cambridge, Edinburgh, or London is indeed not only a promising scholar, but an excellent fellow. He represents, however, as we have seen, only a very small minority—less than one tenth—of the medical students of Great Britain. The rest form a heterogeneous mass, few of whom are likely to become educated men. Not wholly dissimilar—though in general worse—is the situation in America, where the secondary school and college education now required produces the appearance of a high and uniform standard that is not sustained by the facts. For, as I have been at pains to explain, the high schools and colleges are so lax, the cultural background and home environment are so meager, and tradition is as yet so ineffective that the physician is only occasionally an educated man. The best schools are somewhat superior in the cultural quality of their student body to the inferior schools; but even they fall

below the European level. Those who question this opinion may satisfy themselves by comparing the current literature of medicine and surgery in various countries in respect to vigor of expression, background, range of acquaintance with medical history, and other criteria, calculated to disclose not only technical mastery but general training.

II

The special studies of the medical student begin everywhere with physics, chemistry, and biology. It is at this time surely superfluous to emphasize the importance of an adequate knowledge of the basic sciences. The investigator—even the clinical investigator—is constantly driven back upon them; not only does he need good fundamental training in the basic sciences before beginning his medical course, but from time to time he must endeavor by contact and study to keep himself fairly abreast of their progress. The practitioner is in a difficult situation; without a firm and clear grasp of the basic sciences, he cannot comprehend his medical subjects as a student, or read and utilize the current literature when in practice. His chances to study them in the medical school, or after leaving the medical school, are slight. He must therefore enter the medical school well grounded.

Not as yet so obvious, yet gradually becoming more so, is the use that may be made of mathematics and drawing. Students of the biological sciences, one of which is medicine—I speak always of the university student, never of the artisan type, for which, in my judgment, there is nowhere a place in the medical school—ought, if mathematically capable, to bring to the medical school some knowledge of trigonometry and calculus and the ability to draw, to make, and to interpret graphs. Aside from the fact, already dwelt on, that science strives to attain mathematical expression, the student of medicine is increasingly required to understand and to employ formulæ,

graphs, statistical devices, and sketches—now, as the basis of further inquiry, now "in order to control the methods" [1] which he has used. On the other hand, it would be a mistake to try to apply a rigid and uniform formula to all who expect to study medicine; beyond obvious essentials, medicine can utilize various types of ability and training; it is therefore better that the student, if really competent, take hold where he is strong than that he spend his years ineffectually trying to bolster himself, where he is congenitally weak.

Clearly, the acquisition of the complicated equipment prerequisite to the study of medicine cannot be deferred until the student reaches the medical school; it must form a substantial part of his pre-medical training. Thus by force of circumstances the dilemma of the secondary school student in all lands is solved for him: science, mathematics, and drawing must be acquired in the secondary school and college—or there will never be adequate opportunity to acquire them at all.

What kind of science, mathematics, and drawing? Those, who, consciously or unconsciously, view medical education as a kind of glorified trade discipline, favor a short cut: they wish that the prospective student of medicine might have learned just the kind and amount of general science that it is going to profit him, as physician, to know.[2] We shall later hear of clinicians who take the same narrow *"ad hoc"* attitude towards anatomy and physiology. This short-sighted view is assuredly a mistaken one. Such fulfillment of the letter with corresponding neglect of the spirit is bound to be disappointing. Students who have not, in addition to specific acquisitions, the sense for scientific method that can be acquired only where science is broadly, freely, and accurately pursued will certainly not carry into their medical studies modern skill, viewpoint, and spirit.

[1] W. W. Feldman: *Biomathematics*, with introduction by Sir William M. Bayliss (London, 1923), p. xii.

[2] E.g., Schwalbe: *Zur Neuordnung des medizinischen Studiums* (Leipzig, 1918), p. 58.

III

German students vary considerably in the amount of scientific training which they bring to the university from the secondary school.[3] The graduate of the classical *Gymnasium* has had two hours of science every week for nine years. The instruction is mainly informational and theoretic; and it suffers, besides, from the distinctly subsidiary position which sciences occupy in the scale of values. It is doubtless mainly in reference to the classical gymnasiast that Orth deplores the feeble powers of observation of medical students and their lack of training in the inductive method. On the other hand, equally prominent members of the medical faculty continue to prefer the classically trained medical student.[4]

The Realgymnasiast fares better in his last three years, during which science appears on the program five times a week. In the *Ober-Realschule* this allowance is still further increased—to six hours weekly during four years. The following table shows the comparative status of mathematics, natural science, and drawing in the three schools:

HOURS OF INSTRUCTION WEEKLY IN ALL NINE CLASSES[5]

	Mathematics	Sciences	Drawing
Classical *Gymnasium*	34	18	8
Realgymnasium	42	29	16
Ober-Realschule	47	36	16

Thus, as compared with the classical *Gymnasium*, the *Ober-Realschule* gives its students twice the science and drawing and considerably more mathematics. The classical student has ad-

[3] I use the Prussian *Gymnasien* as samples; the *Gymnasien* of other states are similar to, but not absolutely identical with, the Prussian *Gymnasien*.

[4] See, for example, Waldeyer: *Lebenserrinerungen* (Bonn, 1921), p. 55.

[5] In this and the following tables, the number of hours must be divided by the number of classes, in order to obtain the average allotment per class.

vanced little beyond the elements of trigonometry, while the *Ober-Realschule* graduate has studied spherical trigonometry, analytic geometry, and the elements of calculus. The classical student has studied only the "most important" and the "simplest" phenomena in zoölogy, mineralogy, physics, and chemistry; the *Ober-Realschule* graduate has done experimental and mathematical work in physics, and followed a substantial course in both inorganic and organic chemistry.

Of these marked differences in scientific preparation the regulations for medical study at the university take no account. Irrespective of previous training, the medical student is expected to attend lecture courses with demonstrations in zoölogy and botany for one semester and in physics and chemistry for two semesters; in the last-mentioned subject he is required also to take a practical course, for which he must show a certificate before he is admitted to his first medical examination. The *Ober-Realschule* graduate pursues the same practical course, though it is for him mainly a review.

This arrangement is certainly ineffective and wasteful. The *Ober-Realschule* student finds the university lectures superfluous, though he has abundant opportunity to occupy himself otherwise, if he will; the gymnasiast hears—if he does!—too many lectures and does too little laboratory work. The mixture in the same semesters of several basic sciences and the early medical sciences overloads and confuses the curriculum. In addition, the early semesters, in which the basic sciences are necessarily included, are precisely those in which the German university student does least work; for, relieved of the strict oversight, characteristic of the *Gymnasium,* his first semesters are apt to be "verbummelt." [6] Indeed, prior to the war if he started his university career in the spring, he purposely went to a charming place like Heidelberg or Freiburg, where loafing is supremely delightful. The situation illustrates the difficulty of adjusting educational programs to scientific progress; for

[6] I.e., passed in trivial occupations—or sometimes worse. It is said that since the war students have neither time nor money for "bummeln."

it goes back to a time when the secondary school student came to the university without science, and when the basic sciences themselves cut a smaller figure than they now do. Meanwhile, one group of secondary school students has been trained in the sciences, a larger group is still quite untrained, and the sciences themselves need to be reorganized. It is obvious that a redistribution affecting both material and emphasis ought to be effected which would give the trained group some advantage over the untrained and which, as in France, Great Britain, and America, would disentangle the basic from the strictly medical sciences.[7]

IV

The opportunity of the French boy to study science in the *lycée* is, on the whole, inferior to that of the German, and, though the equipment is often excellent, the instruction is hardly so satisfactory. The secondary school, as I have explained, occupies seven years, divided into two cycles, respectively four and three years in length. During the former, under the régime of 1902, from one to two hours weekly were given to science, two hours weekly to drawing. The difference between the classical and the modern branches came with the second cycle, during which the student, following the modern line, might devote five hours a week to science during each of three years, and continue to give two hours weekly to drawing. The official bulletin to teachers of sciences informed them that they were not expected to make professional physicists and chemists, but rather to "acquaint their pupils with the great laws of nature and to put them in position to understand what is going on in the world about them." The pupils were to know, rather than to find out. A symmetrical scheme rounded out from the informational point of view served this purpose better than a less schematic treatment which expects the pupil to do

[7] The German student solves the problem for himself by absenting himself, or doing something else, but sound organization would be a preferable solution.

things for himself. The management of the course naturally harmonized with its didactic purpose; for the pupil in chemistry, for example, instead of helping himself, found his apparatus and chemicals placed on his desk by a competent servant, who, after the student, following directions, completed the "experiment," also removed the litter. Arrangements were so carefully and tidily made that the pupil was in little danger of soiling either his hands or his clothes. To what extent the arrangement just described will be altered by M. Bérard's reform is not clear.

The student of medicine is, however, required to spend an additional year of a preliminary character in physics, chemistry, and biology. Unlike the corresponding instruction in Germany, the so-called P. C. N.—physics, chemistry, and natural history—is in France independent of, and antecedent to, the medical course, as it should obviously be. The instruction is, moreover, of secondary school type, and far more practical in character than the work of the *lycées*. The three subjects are simultaneously and systematically pursued—lectures being given in the mornings, laboratory exercises following for three hours in the afternoons—one afternoon weekly being devoted to physics, one to zoölogy, one to botany, and two to chemistry. The classes are organized in divisions, the members doing the practical work as individuals in some subjects, in small groups in others.

The P. C. N. instruction constitutes an efficient drill in the elements of the basic sciences. Curiously enough, classicist and modernist pursue identical courses, despite the difference in their secondary school courses. It is plain that the entire scheme has not yet been logically and economically organized, either in France or Germany. Criticism is not lacking. The laboratory men complain that the medical student knows too little of the basic sciences; the clinical teachers complain that the instruction, given as it is in the faculty of science, has too little reference to the specific needs of the medical student. On general principles, one cannot sympathize with the clini-

cian; for assuredly the medical student, like the engineer, needs to know chemistry—the theory and the practice of chemistry as science and logic, rather than the few practical chemical processes which from time to time the practitioner may have occasion to apply. But, as we have seen, it is small wonder that the French clinician wishes to convert chemistry into clinical chemistry, for the clinician dominates medical education in France; the sciences are all regarded as merely helps to the clinic; why not chemistry and physics, too—like anatomy, pharmacology, and pathology?

V

Conditions in Switzerland, Holland, and Scandinavia are not substantially different from those described in Germany. The Dutch pupil, for example, leaving the elementary school may go to the higher burgher school for five years or to a *Gymnasium* (classical or modern) for six years. The following table exhibits the amount of instruction in science that he will receive according as he chooses one or the other:

HOURS OF INSTRUCTION WEEKLY

Holland

Subject	Burgher School (5 years)	Classical *Gymnasium* (6 years)	Modern *Gymnasium* (6 years)
Mathematics	30	17	23
Science	27	8	16
Drawing	11	—	—

Sweden

Subject	*Real* School as basis followed by either Classical *Gymnasium* or Modern *Gymnasium*		
	(5 years)	(4 years)	(4 years)
Mathematics	23	18	25
Science	14	13	26
Drawing	8	8	8

The competent, standardized, and predominantly informational training in science, mathematics, and drawing obtained by the secondary school student on the continent is, as I have pointed out, followed by demonstrative scientific courses at the university which repeat and elaborate the work, especially on the theoretical side; but with this distinction—that in the secondary school the student must learn or quit, while at the university he learns much or little, as he pleases. Even the examinations, as we shall learn, are not severe; a stark ignoramus cannot hope to pass, but the expert coach is not unknown and a glib tongue or ready pen often procures a university degree for persons whose knowledge of the basic sciences is by no means adequate. The state examination, described in the preceding chapter, is the real sieve.

English practice in respect to the basic sciences is at this moment in transition. Hitherto the first year of the medical curriculum has been devoted to the three basic sciences, taught on an elementary basis at distinctly a schoolboy level, and in a mechanical and humdrum, rather than an imaginative and scientific spirit. The work has been concrete; but the equipment is meager and the atmosphere unsympathetic. It would be difficult to imagine anything less likely to open the student's eyes to the fundamental significance of these studies for medicine than the perfunctory character of the instruction in physics and chemistry given in the medical schools.

Simultaneously, however, a different spirit and outlook prevail at Oxford, Cambridge, and other universities. The requirement is still secondary in character—so much so that well prepared students who have been "taught some science at school" may meet the requirement in the subjects by examination at the outset; others can complete the work within a year. But the environment makes an enormous difference. Students pursuing even the elements of physics and chemistry in laboratories where Rutherford, Hopkins, and their disciples are at work and do the elementary teaching, not only learn, but absorb something that is not contained in the syllabus.

And it is always to be remembered that the situation favors prolonged individual work by the occasional student who cares.

The new regulations of the General Medical Council remand two of the basic sciences—physics and chemistry [8]—to the premedical curriculum. It is intended that they shall form part of the secondary school course; as such they will be subject to all the vicissitudes heretofore described. In the grammar schools of the large municipalities and on the modern side of a few public schools and colleges, excellent fundamental instruction will be given; especially sixth-form students who have concentrated on science may not only acquire a large body of knowledge, but may become more or less independent workers, free from the leading strings by which the mere schoolboy is held. In most of the two hundred schools, however, which are "recognized" by the Board of Education, the opportunities will be distinctly elementary. As between the latter and the perfunctory instruction hitherto obtainable at the medical school there will for the immediate present be little to choose. What will ultimately happen, it is difficult to predict. The medical school could never develop the subjects beyond routine. As secondary education improves, instruction in science may be bettered. Meanwhile, not a few of the medical departments of the universities propose, for the present at any rate, to keep the subjects wholly or partly in the medical curriculum—as is done on the continent.

American conditions are apparently standardized at a rather high level. The high school always offers some science, and the best city high schools offer excellent practical instruction in science and manual training. It is surely no exaggeration to say that a first-rate American high school does much more than meet the requirements of the General Medical Council. In smaller urban and in rural high schools, the science teaching is often both confused and pretentious: the time card may offer much; but the preparation of the teachers is irregular and the facilities run the gamut from good to wretched. Regardless,

[8] Not zoölogy.

however, of the secondary school, in which science may be either thus very good or practically nil, almost all medical schools now require two years of college work, of which one year must be given to physics and biology and one and a half years to chemistry. Laboratory as well as book instruction is required.

Unfortunately, in respect to the sciences as in other respects, colleges, like high schools, vary enormously; and inasmuch as the poorer high schools send their pupils largely to the poorer colleges, the result is heterogeneous to a high degree. The situation is unsatisfactory for another reason already adverted to. Even good American colleges retain far too often the type of organization that obtains in the elementary schools. Subjects are organized in classes and hours and units, so inflexibly that the pupils—good, bad, and indifferent—carry the same load. The able and the stupid, the industrious and the indolent, the brilliant and the slow—all alike do "fifteen hours a week" every college year. Thus from the standpoint of scientific knowledge and training, the American two-year college men represent widely parted extremes in knowledge and training, though the best of them may have worked under conditions as favorable to initiative as those that obtain in the German and English universities and the sixth form of the English grammar and public schools. It must be understood, however, that inasmuch as the medical schools exercise a certain selection, they are not likely to admit into the entering class a group that is as heterogeneous as the general conditions suggest; for each school draws its students from secondary schools and colleges which its authorities know more or less well; hence, the best medical schools may respectively obtain a fairly homogeneous group, though, I again strongly suspect, distinctly less homogeneous than the authorities believe. Thus, the number of students in the first year medical class of our best medical schools capable of doing accurate work or following graphic representation in general physics and chemistry is, while larger than a decade ago, still deplorably small. It is

the old story commonly encountered in American education—sacrifice of quality, preoccupation with quantity.[9]

VI

The preceding account makes clear that conditions in the basic sciences are more favorable in some countries and less favorable in others. But however well the work has here and there been planned, its execution is far too frequently inferior to the conception. An economy of time must be effected by a clearer understanding of what belongs to the secondary school and to the medical school respectively. Both practical and theoretic instruction must be amplified; above all, in America, larger and freer optional opportunities must be created for the benefit of the able and industrious. It is not, of course, impossible even now for the interested student to step off the moving platform on which all students glide within the same period of time to the appointed goal, in order to pause at some particularly attractive spot. But it is not done. Such precedents need to be created. Is it too much to hope that at some not too distant time in the future, not the dull, but the talented student will be he who reaches the medical school by the slower route?

VII

The literature of scientific medicine appears in all the languages of Western Europe, but, for the most part, is readily and promptly accessible to those who are at home in English, German, and French. The need of knowing modern foreign languages is not limited to the advanced investigator; even the student in the medical school has from time to time to consult untranslated authorities or to run down a subject in foreign journals.

On the continent, conditions favor the acquisition of foreign languages—especially in the smaller countries, where business,

[9] This opinion is sustained by testimony independently furnished by ten or twelve physiologists and biochemists in the three or four leading American medical schools.

study, and pleasure bring persons of different nationalities into frequent contact with the native population. The cultivated Swede, Swiss, Hollander, and Dane always read and frequently speak, even if more or less haltingly, French, German, and English.[10] The universal use of French as the language of diplomacy has perhaps in a measure relieved the French of the necessity of mastering other languages. Hence, educated Frenchmen do not commonly read, and seldom speak, either German or English. In Germany a reading acquaintance with French and English is practically universal among educated men; the speaking of French is common and of English by no means rare. In Great Britain French is read, sometimes spoken, German less frequently read and very rarely spoken. America makes a poor contrast. Scientific workers have in course of time to acquire the ability to read scientific articles in French and German; but a fair degree of mastery, whether for reading or speaking, is rarely encountered. Even at Montreal, where both French and English are spoken languages, few of the McGill students are masters of both and the faculties do nothing to counteract common prejudice. A generation ago, the ambitious student in the United States went abroad for prolonged periods of study; thus a small band actually acquired one or two foreign tongues. But as educational opportunities have improved at home, fewer students go abroad for long periods. It is, nowadays, not uncommon to find promising young scientists, occupying or about to occupy important posts, laboratory and clinical, who have not only never worked outside the United States, sometimes, indeed, not outside a single institution in the United States, but who really command no language but their own—a thing that could not happen in Germany or the adjacent countries to the north and west. In consequence there has probably been a decline in the number of native Americans who are fluent in German and French,

[10] In the smaller countries, textbooks in common use are rarely in the vernacular; it would not pay to print them in Danish, Swedish or Dutch. Hence, students use French, German, and English texts.

though, undoubtedly, there has been an increase in the number of those who can painfully decipher a paper dealing with their own subjects. This is a poor compensation, however, for the personal friendships, stimulating intimacies, and deeper insight obtainable by those who master a foreign tongue through living and working in the country in which it is spoken—as did the men of the generation just passing who put American medicine on its feet. Thus many of those who are now training the leaders of the next generation are, with all their technical proficiency, culturally thinner than their contemporaries on the continent. Unless steps to the contrary are vigorously taken, a new provincialism will develop in America, at a time when the general level of medical teaching and research has decidedly risen—and, indeed, perhaps, unwittingly, for that very reason.

Meanwhile, continental secondary schools and colleges everywhere recognize the importance of foreign languages, not only by giving them increased time in the newer programs, but by devising more practical methods of instruction. A generation ago, German, French, and English were taught very much as Latin and Greek were and are still approached, namely, through formal grammar and choice literary specimens. The secondary school student was eventually enabled to construe a passage from La Fontaine, Schiller, or Addison, but he could not ask the time of day or the way to the railroad station. The direct method has now quite generally modified this procedure in a practical direction. Languages are begun earlier—before the grammatical approach is feasible; speaking and understanding of the spoken word are strongly emphasized, and the newspaper and conversation on everyday topics are to some extent utilized as well as the classics.

The importance—practical as well as cultural—which is attributed to foreign languages on the continent may be gathered from their prominence in the school program. In Sweden, German and English are taught throughout the nine-year period of the combined *Real Schule* and *Gymnasium*, French being usually limited to the last four years; in France, foreign

languages [11] now begin in the preparatory school and continue throughout the seven years of the two cycles into which the *lycée* is divided; in Germany, French or English may be begun in the preparatory schools; in the classical *Gymnasium,* French is taught for seven years; in the *Realgymnasium,* French for seven and English for six years. The periods of instruction are generally, on the continent, an hour in length; the teachers, though natives of the country in which they teach, are, as a rule, competent, because through study abroad they have acquired fluent speaking command of the languages they teach; the native language is more and more commonly banished from the classroom, the work is seriously pursued, and pupils work hard.

In Northern Europe, therefore, the medical student has a reading and sometimes a speaking command of two modern languages in addition to his own. Unfortunately, at the moment, the disturbed condition of international exchange and the economic depression, general throughout the continent, has seriously interfered with the purchase of foreign books and the circulation of foreign periodicals.

In England and the United States conditions are so irregular and chaotic that generalization is impossible. A few high or secondary schools are good; and capable teachers are occasionally discovered. But no standards have as yet been generally established. The instructor is often not a trained teacher, but an accident—a fairly cultivated foreigner who turns to teaching because he has found no other niche. Sometimes he is a native Englishman or American who has learned what he knows of foreign languages at school or college; often the same person teaches both French and German without knowing either well. English is still as a rule the language in which explanations are made and questions asked and answered. The instruction "succeeds" if the pupil can pass a written examination involving the translation into English of a short passage from

[11] In the south, Italian and Spanish are prominent—in some places at the expense of English and German.

a German or French classic, and answer in writing the sort of grammatical questions that figure on the Latin or Greek paper. The college or university teacher of modern languages is of higher quality; but the game has been lost before he takes a hand in it, and besides, the time at his disposal—a year or two—is insufficient. It is fair to say that neither public nor educational opinion yet fully appreciates in either Great Britain or America the great practical and cultural importance of foreign languages, or the fact that they can be learned only if begun early and taught competently.

The resulting situation, in so far as medical schools are concerned, may be briefly summarized:

In Great Britain, students who begin the study of medicine on the basis of the requirement formulated by the General Medical Council are not required to have any acquaintance with either German or French; it is indeed possible to begin the study of medicine at the great universities—Cambridge, Oxford, or Edinburgh—without the ability to read a modern foreign language. Of other medical students in England and Scotland today, hardly ten per cent. are candidates for an arts or science degree, and probably know something of one language or the other, or of both.

In the United States and Canada there are now about ninety medical schools. Something like twenty make no explicit requirement in foreign languages at all; almost fifty make some —a "reading"—requirement in one language; eight seem to require a fairly substantial training in one language, a few make this requirement in two languages. But the facts are far less satisfactory than the figures. For the medical schools that require modern languages—one or both—apply no genuine test; and the paper testimonial that they commonly accept does not really guarantee the degree of command which the student is assumed to possess. A large proportion of students admitted to university medical departments on the basis of ability to read a modern language cannot make out the meaning of a simple piece of French or German. The requirement is

not enforced, and no university has yet frankly admitted and faced the fact.[12] The difference between schools that make no requirement at all in French and German and the schools that require one or both is therefore much less than the catalogues imply. The situation is somewhat better than that in Great Britain, but decidedly inferior to that of most continental nations.

In closing a word may properly be said as to the native tongue. Every nation gives first place in the elementary and secondary curriculum to its own language. But no nation succeeds like the French in training its children to fluent and elegant usage—spoken and written. Something of this result may be ascribable to native endowment; something to the inherent qualities of the language; but infinitely more important than either is the pressure exerted by public opinion. A high standard has been created; severe effort is conscientiously and deliberately made; admirable texts gradually increasing in difficulty are in universal use; and the Frenchman who cannot speak and write his own language clearly, readily, and agreeably is hopelessly handicapped. It may conceivably happen that occasionally a loss is thus incurred—that the mute, who possesses talents that would disclose themselves otherwise than by speech, is rejected. The more common effect, however, is to stimuate effort, with the result that the ability of the Frenchman to express his meaning clearly and gracefully is unique.

It would, however, be incorrect to interpret the Frenchman's mastery of expression as merely linguistic fluency. It has, indeed, a deeper significance. The *lycée* is enjoined to train its pupils in "philosophy"—not in the technicalities of logic or metaphysics, but in the capacity to generalize and correlate. The lucidity and readiness of the French boy who has just

[12] I base this statement on a simple examination in French and German given through the courtesy of several university authorities. About 50% passed in French, about 25% in German. These figures bear out what I have said in the text regarding the quality of high school and college education and the heterogeneousness of even picked university students. There is no reason to suppose that other subjects are better taught than are modern languages.

won his baccalaureate is thus the hard-won result of years of training, not only to retain facts, but to put them together and to draw forth their meaning. To be sure, there is something that is artificial and imitative in the process; but it leaves its mark in a definite and unrivaled style of conception, expression, and exposition.[13] Other continental nations, particularly the Germans, have less successfully made a somewhat similar endeavor to discipline the adolescent in the art of philosophic discussion, but the language and the national temperament lend themselves much less well to the effort. The German student, like the German professor, may express himself with force, but as a rule without grace or lucidity.

In this matter America again makes a very poor showing.[14] Our schools and colleges have not yet successfully taught the art of arrangement and expression. The student and sometimes even his instructors are all too often clumsy, ineffective, and inelegant in the use of their native tongue. The causes are not far to seek. A generation ago or less the families from which many of the most enterprising come were speaking in other tongues, not infrequently a patois or jargon. The difficulties are therefore enormous; only unusual teaching skill and severe pressure, based on widespread appreciation of the importance of the object, can hope to succeed. But these are precisely the missing factors. The teachers of English are rarely well trained; and there is no general recognition of the need of working hard to acquire correct English style and diction. The student's progress is, therefore, impeded by deficiencies in the use of the English language —the more seriously, the further he advances.

[13] Fluency is still further developed by the use of oral examinations at every stage of the student's progress. His entire future depends on his ability to speak and write clearly.

[14] A faculty committee of a strong university, which, having more applicants for its medical school than it can admit, selects its students and claims a relatively homogeneous body at a comparatively high level, deplores in its report the inability of many students either to speak or to write good English.

VIII

We have now brought the medical student to the threshold of the professional school; on the continent, indeed, he has one foot across, for the physics, chemistry, and biology, which the *Realgymnasiast* and the *Ober-Realschuler* have pursued in the secondary school, are repeated in the early semesters at the university. We have learned that, on the whole, he has on the continent received a severe and excellent general education—that, at least, he has acquired the ability to work; that in Great Britain and America, no such selection has been made and no such intellectual training has been generally procured, though the medical student may be a more wholesome human being. No nation has thus far satisfactorily managed the specific training in the basic sciences—the importance of which is universally conceded. Longer and better training in the secondary period, on both practical and theoretical sides, and the elimination of duplication are unquestionably desirable.

Such as he is, how old is the student of medicine at the beginning of his professional studies?

The German scheme allows twelve years of systematic schooling before matriculation in the university. A boy who begins at six would thus theoretically arrive at the university, which is, be it understood, a professional, not a secondary school, at the age of eighteen. As a matter of fact, a fair number run on schedule time. For example, of 264 students who entered the medical faculty at Berlin in 1913,[15] 36 were 18 years of age; 60 were 19, 80 were 20, 45 were 21, and 20 were 22. These figures are doubtless representative for Germany, where, it may be said, under normal conditions, the student begins his medical studies at the university when approximately 20 years of age. Six years or more elapse before his studies—including the practical year—can be completed: he is, therefore, under favorable conditions, in his twenty-seventh year.

[15] This date was selected in order to avoid disturbances due to the war.

In the United States in 1922 the mean age of students entering eight important medical schools in different sections of the country was slightly under 23, though, to be sure, a few enter at 18 or even below, and a few at 30 or thereabouts. In general, however, the American boy, who takes an internship, as most of them do, will hardly enter practice until his twenty-ninth or thirtieth year. In Canada, where the period of general training is shorter, the period of professional training longer and the internship less common, students are likely to begin their medical studies under twenty and to complete them—without the internship—at twenty-five.

In Great Britain students who begin medicine on the basis of university matriculation are for the most part slightly below 19 years of age; those who offer a recognized certificate a trifle over 19; the few who first take a degree in arts are practically 23—by which time, however, they have also accomplished part of their medical course.

Though the statistics involved are extremely complex, it is apparently true that the student of medicine in the United States has in general spent more years in school and college than the student of any other nation, without, as we have abundantly shown, receiving as good an education as some others who have spent two years less. The continental student might indeed obtain a more modern or flexible training, but he can hardly expect to economize in the matter of time. The American student ought to spend less time and to obtain in the reduced number of years a more thorough education. A large proportion of British students are from the standpoint of the demands of modern medical training immature and undereducated. The age of beginning should be somewhat raised, but no more rapidly than is required to keep pace with improvements in secondary education.[16]

[16] The above paragraphs attempt to give only a non-technical summary of the situation. A careful statistical study of the subject, in so far as the United States is concerned, by Professor Theodore Hough, of the University of Virginia, appears in the Journal of the American Medical Association, June 30, 1923, pp. 1926-1937.

CHAPTER V

CURRICULUM

A—EUROPE

I

Medical schools exist because disease must be studied, understood, and controlled; and physicians are trained that they may the more intelligently and efficiently prevent, or, if not prevent, then combat, disease. The understanding of disease involves prior knowledge of the normal functioning of the human body and of the agencies and conditions—social as well as individual—that are likely to cause trouble; the cure of disease involves such prior knowledge of structure, function, and environment as will enable the physician to recognize departures from the normal, and such knowledge of therapeutic and hygienic measures as will enable him to deal intelligently with them.

The physician must then in the first place be able to detect differences. Now the detection of differences implies that somehow there has been previously set up in his mind a picture or conception of the structure and the functioning of the human body in health. The perception of abnormality or irregularity can only take place against the background of normality or regularity. The mind must have been stored with an image which, in the words of Professor James, will "go out to meet the impression received"[1] from the ailing patient. The prior existence of the image of the organ, member, or function, in health is thus the necessary condition to the

[1] See *Psychology* (New York, 1902), Chapters XI, XIII.

prompt and clear perception of abnormality.[2] In outline and detail the normal picture or conception must not be too rigid or too definite, for structure and function may both be normal within wide variations; but if the picture is initially too sharp, experience will wear down its edges and soften the lines. It is not, therefore, to be supposed the student should first learn all about the body in health, and subsequently learn all about it in disease. In the first place, he will never in any event learn all about it, either in health or in disease. In the second place, as time goes on, conceptions of health and disease react upon and modify one another. That is, successive experiences will enrich the mind in both respects. Contact with variations in health due to individual differences and to age, as well as contact with variations, characteristic even of specific diseases, will to the end of his experience progressively modify the too definite outline and fill in the too sketchy picture with which the student may have begun. How can this background, so important as the point of departure, be most economically and effectively created?

Two methods of building up the conception of normality against which the phenomena of disease stand out, have been and still are employed.

Apprenticeship is the older way. It was as an apprentice—an assistant, really, rather than a disciple—entirely ignorant of the entire subject, that, as I have already pointed out, the intending physician originally began his studies, or better still, his experience. A mere boy, fresh from school, he attended his preceptor in his office and on his visits. To the apprentice, as

[2] Though, as we shall see, French teaching proceeds upon the opposite theory, Claude Bernard advocated the procedure which I have just described in the text. In his *Introduction à l'Étude de la Médecine Expérimentale,* he says: "La science ne s'établissant que par voie de comparaison, la connaissance de l'état pathologique ou anormal ne saurait être obtenue sans la connaissance de l'état normal, de même que l'action thérapeutique sur l'organisme des agents anormaux ou médicaments, ne saurait être comprise scientifiquement sans l'étude préalable de l'action physiologique des agents normaux qui entretiennent les phénomènes de la vie." (pp. 6 and 7).

to the infant, his early contacts must, in the words of William James, have been only a "great, blooming, buzzing confusion." [3] He saw only the sick; but, of course, they were not sick all over; necessarily, in the course of examining the patient, his master classified this organ or appearance as sound, that, as pathological. Gradually, the sound features, continually differentiated, came—or were supposed to come—together in the imagination of the apprentice, somehow constructing a more or less coherent picture of the body in health; while, by a similar process, abnormalities in structure and function came together in sets and ultimately formed more or less definite types of disease. The complicated processes of sorting out and grouping impressions into an increasing number of differentiated pictures—these normal, those abnormal—all went on simultaneously from the beginning. Thus the apprentice,[4] and thus later the clinical clerk in the hospital school, built up his contrasting ideas of health and disease.

If we may adopt the phraseology of language-teaching, apprenticeship is the "natural" method of learning medicine: "natural," because thus we obtain our mastery of the native language and our early impressions of the world into which we are born. It answers better than any other method yet found for the learning of some things in early life—languages, for example. For the linguistic battering is so persistent, and the word combinations are so rapidly and frequently changed, that the child soon recognizes the separate word-elements and soon acquires skill in manipulating them. In respect to the senses, however, the "natural" method is both a confused and a precarious procedure—so costly and so racking, that the child is unconsciously led to protect his perceptions against assault by learning how *not* to notice. Thus, through the expedient of ignoring the world as far as he chooses, he simplifies the

[3] *Psychology*, loc. cit., Vol. I, p. 488.

[4] "Clerk" is the British designation; roughly equivalent is the French "stagiaire," the German "Praktikant" or "famulus," the Scandinavian "volunteer."

situation for himself, economizing his energies and preserving his nervous stability. The natural method then is the only possible method of learning in infancy; it is perhaps the best method of learning one's native tongue. But in respect to other forms of knowledge it is a costly and blundering method. Nurses, parents, teachers, and the child himself seek to escape from it, or to mitigate it.

The alternative is the systematic and ordered approach of the schools, which make a selective and progressive demand upon the faculties of perception, discrimination, and organization. Within limits, which I shall strongly emphasize, schools proceed analytically, first familiarizing the student with the elements which are subsequently encountered in synthesized or integrated form. The symptom complex which the physician encounters in the sick man cannot be resolved unless he is already in possession of the separate factors involved. He must know the rate and "feel" of the normal pulse before he can estimate the extent and significance of the abnormal pulse. "The assafoetida in 'Worcestershire sauce' is not obvious to any one who has not tasted assafoetida *per se.*" [5] Thus chemistry and physics are studied before physiology—the relatively simple before the relatively more complex. Not inconceivably some chemistry and physics might in time be disentangled from physiology, if physiology were taken up without previous knowledge of them; but common sense, with which pedagogical sense coincides, places the basic before the medical sciences on the theory that, if the student first learns the chemical and physical alphabet which physiology and anatomy employ, his progress will be expedited. The two sets of subjects will, of course, react upon each other; the elementary knowledge of physics and chemistry with which he begins the study of the medical sciences will be enlarged as he learns more physiology and more anatomy.

A similar question as to sound pedagogical order or arrangement arises as between the pre-clinical and the clinical

[5] James, loc. cit., Vol. I, p. 504.

subjects. Unquestionably the student, at least the really able student, entering the clinic without previous knowledge of anatomy, physiology, or pathology, may learn in time to disentangle normal from abnormal, and thus obtain the contrasting conceptions without which he cannot make a diagnosis or plan a procedure. But sound pedagogy suggests that the student on approaching the patient should already be in possession of the alphabet in terms of which he must express himself, or, to revert to the terminology already employed, the picture of normality, against which disturbed function and appearance will at once contrast itself—skin, pulse, tongue, secretions, etc. Once more, the normal and abnormal will react upon each other. The image of normality will be there "to go out to meet" and challenge the perception of irregularity. The student thus forearmed will, to be sure, bring to the clinic in the first place a sketch too sharp in outline and deficient in details; in the process of learning he will, however, become sensitive to delicate shadings, to slight hints, to inseparable overtones. The provisional separateness with which medicine has been, for simplicity's sake, at first presented to him, tends thus ultimately to disappear of itself, and the entire field tends towards something approaching unity. But this development takes time and reaches beyond the medical school.

It is, however, a curious—and for medical, as for general, education, a significant—fact, that over-organization of school material at any level defeats its own purpose. Neither childhood nor youth learns at maximum capacity if things are utterly chaotic; neither do human beings learn at maximum capacity if things are over-simplified, if they are over-organized, if they are over-analyzed—if, in a word, nothing is left to severe effort or to chance. The schoolmaster—or for the matter of that, the university professor—who is too analytic sterilizes the material and paralyzes the pupil; the student must get somewhat beyond his depth, in order to recover his footing. While, therefore, it is sound to proceed from the known to the unknown, from the simple to the complex, it is equally impor-

tant not to eliminate struggle with the complex and the unknown.

If we have now succeeded in formulating a logical conception of a curriculum designed to train students of scientific medicine,—or, indeed, students at any level whatsoever—it will appear that, in principle, the medical curriculum does not differ from the curriculum in architecture or engineering, both of which, in general, follow the analytical rather than the "natural" procedure. The student of architecture does not begin by watching the architect or helping him to make plans, draw up specifications and build houses; nor does he play about for years in an architect's office, "something between a hindrance and a help." He applies himself to the study of mathematics, physics, and drawing. The student of engineering—civil, electrical, mechanical, or what not—does not participate in the planning or construction of bridges and canals, learning his mathematics and physics inferentially and incidentally. On the contrary, he applies himself assiduously to the study of mathematics, physics, chemistry, and drawing, no matter whether they seem to him interesting and relevant or not, on the theory that he must master the elements of his profession, if he expects in due time to acquire its technique.

II

To the logical arrangement of the medical curriculum two objections are made: first, that it involves the presentation of subjects—at the outset, the laboratory branches, subsequently the clinics—in water-tight compartments; second, that the student, not perceiving at once the use or bearing of anatomy and physiology, fails to develop interest in them. It does not, however, follow, that because, in general arrangement, a curriculum pursues a logical order, its component parts are rigorously shut off from one another. Mathematics, physics, and drawing are separate subjects in the engineering curriculum; but no one of them is taught without reference to the others.

On the contrary, they constantly recall and support one another. So physiology constantly recalls, supports, and extends anatomy, chemistry, and physics. One may avoid "water-tight" compartments without either beginning the course with clinical instruction, or prematurely mixing the laboratory and clinical subjects, or running them parallel to one another.[6] Physics, chemistry, anatomy, physiology, pathology, and medicine, presented in their logical order, will irradiate one another, as well as the basic sciences—provided only the teachers are broadly trained scientists who see their immediate problems in common, fundamental terms. Assuredly the importance attached to the proximity of physicist, chemist, physiologist, pathologist, and clinician in the university has a significance which will emerge in discussion, argument, and coöperation—now casually, perhaps at lunch or tea, now by presence in one another's laboratories, again by systematic, even though occasional, contact at the bedside.

The argument in behalf of mingling clinical and pre-clinical subjects in order to interest the student is assuredly not convincing. Interest is indeed at every stage a powerful educational factor; but mature young men, at the stage of college graduation or thereabouts, may fairly be expected to put forth effort in anatomy and physiology, without being at every step amused or misled, as premature playing with clinical problems is bound to mislead them. But there is something more damaging than misconstruction or misinformation involved. In the long run, as we shall see, the physician's capacity for growth in his profession largely depends, like the engineer's, on his grasp of the underlying sciences.[7] A clinical illustration may indeed clarify the student's comprehension of a fundamental principle or fact; but, at least in excess, it is more likely to excite a superficial interest in symptom or remedy. In-

[6] Professor Poll, formerly of Berlin, but just called to Hamburg, suggests, as a legitimate help, an introductory course of lectures in general biology, portraying the relationships of the various subjects.

[7] Billroth discusses this point admirably. Loc. cit., pp. 92-3. I shall recur to the question in discussing clinical instruction (pp. 238 ff.)

stead of abandoning logical order for the purpose of capturing the attention of students whose intellectual discipline has already been too long postponed, the medical school can perhaps do a finer service—moral and educational—by making upon the student a demand that challenges his ability to work towards a deferred end. Anatomy, physiology, and pathology are in themselves sufficiently fascinating; the student who finds them dull has presumably seated himself in the wrong pew. The subjects ought, of course, to be taught by men who know and expound them in relation to the large field of inquiry out of which they are merely tentative and provisional groupings for the sake of convenience; but they ought not to be diluted or disguised or adulterated, in order that immature, untrained, or unresourceful youths may frankly be spared intellectual effort.

III

The medical curriculum should, then, it would appear, be constructed on a logical rather than a "natural" basis. Is it possible to deal on the basis of principle with the amount of material which it should contain?

The answer depends on our conception of the part played by the university in professional training. As a matter of fact, schools of engineering do not produce engineers or architects; schools of law do not produce lawyers. Very wisely have the Germans said: "Only as a physician does one become a physician." [8] Education and, above all, professional education, is self-education. The school's part is largely limited to training in method and technique, and to inspiration.

A bare recital of the different subjects into which, for convenience of handling, medicine has been broken up will dispose of the notion that any curriculum, however long or however crowded, can contain and deliver to the student the knowl-

[8] *Unterlagen für die Neuregelung der ärztlichen Prüfungsordnung* (Berlin, 1922), p. 10.

edge, skills and technique which it would profit him to possess. The medical curriculum cannot, therefore, be encyclopedic; it cannot be organized from the standpoint of facts or knowledge. There are, indeed, in every science a few common facts or principles, which, however the subject is approached, will be included—the alphabet of the several sciences, so to speak. No one will study chemistry without learning the elements; physics without attention to the laws of motion; biology, or physiology, or pathology without the concept of the cell. But once these letters of the alphabet of the respective sciences have been mastered, technique, spirit, point of view rather than information, become the important matters. To be sure, the student needs to know some things well in order to be able to observe, compare, draw conclusions; but the power and the will to observe, compare, and infer, which always involve knowing particular things well, are more vitally important than the knowledge of any particular set of facts as against some other set. In any event, no two persons would ever agree on the particular sets of facts and skills which the practitioner needs to master.

It is clear, therefore, from reflection, as it has been made clear by experience, that a selective and varying, not an encyclopedic or uniform, a lightly laden, not a too crowded, curriculum offers the best opportunity for the training requisite to mastery and growth. Some things are obviously less fruitful than others. These may, in the absence of good reason to the contrary, be postponed. As for the others, it is neither necessary nor practical to arrange them on the scale of their supposed relative importance.

IV

Medicine is an indefinite portion of the vast field of biology, which is being gradually subjected to physical and chemical methods. For purposes of effective attack, the area to be explored—itself only tentatively marked off—has been provi-

sionally divided; but the several portions have really no distinct individuality; on the contrary, they merge into one another, and are liable to re-grouping, whenever they are surveyed from a new point of view. Thus, on the descriptive basis, anatomy, physiology, and pathology may be conceived as the sciences of normal structure, normal function, and abnormal structure and functioning, respectively; but if the three sciences are regarded from the functional point of view, the provisional barriers, just erected, disappear; physiology includes them all—anatomy becoming that aspect in which, for convenience' sake, most, though not exclusive, attention is paid to structure, and pathology that aspect which pays, for the time being, most attention to departures from the normal order.

The subdivisions become more and more difficult to preserve as entities, even provisionally, as one goes deeper. The moment the whole domain is conceived from the standpoint of physical or chemical method, the provisional delimitations insist upon vanishing. Biochemistry, pharmacology, bacteriology, serology, immunology are all shifting and developing divisions. They refuse to stay in any particular place; teachers and workers, whatever they call themselves, poach on one another's preserves; a line of demarcation, drawn by one person for one purpose, is obliterated when someone else draws another, either for the same ultimate purpose, or for a different one.

The situation is not a whit more stable on the clinical side. Disease is indeed an entity, for otherwise scientific study would be impossible. But it does not follow that the line between the pre-clinical and the clinical sciences is anything more than a convention, useful in research and still more so in education. Even more tentative in character are the usual clinical subdivisions. Pediatrics, surgery, and obstetrics are not natural domains, divided by definite boundaries from internal medicine; they are provisional units, artificially set up—no two persons drawing exactly the same lines; and the lines, however drawn, disappear when, for some special purpose, the entire field is resurveyed. Thus, the student of metabolism

or cardiac disease or infectious processes cuts across the orthodox clinical divisions, above mentioned. The fact is that the entire field covered by the medical curriculum is a unit, itself part of a far larger unit, all of which is variously carved up, according as one purpose or another is to be served.

Medical education cannot be contrived in disregard of the facts just stated. If the so-called basic sciences, medical sciences, and clinical sciences do not form a definite and differing series of entities, but are merely so many attempts to simplify and organize an otherwise unmanageable whole, it is once more clear that there need and can be no such thing as uniform medical faculties, composed of the same chairs, occupying the same territory. The same name may legitimately cover different parts of the field and represent various types of interest and approach, all of which may be valid whether from the investigative, practical or educational point of view. The entire field would be covered by a broad conception of physiology or pathology. Nor can there be any such thing as a uniform, complete or stabilized medical curriculum. Under existing conditions, as we shall learn, there is in most countries less danger to be apprehended from chaos than from uniformity. I have already made a plea for a general logical progression leading from the fundamental sciences (viz., physics, chemistry, and biology) through the next steps (anatomy and physiology) to the uppermost story (pathology, internal medicine, and surgery). Even within these several subjects so-called, the necessities of comprehension enforce a somewhat similar progression. The student who attempts to study immunology, for example, without knowledge of bacteriology or physiology, would learn a valuable lesson in another field than that of the subject itself; for the waste of time would teach him a needed lesson in logic—and it is better that he should occasionally stray into the rough than that he should be kept from all possible harm through too careful shepherding. For careful shepherding will inevitably deceive him into believing that the particular bits of knowledge and training selected for

him possess a peculiar and unique importance, apart from the technique, interest, and momentum which represent their main contribution to his growth.

The argument against rigidity and uniformity is to my thinking conclusive. But it does not follow that the student's freedom must be utterly uncontrolled: "There is a ditch on each side of the road." Certain logical relations necessarily obtain within the stuff of which medical curricula are made. The student has no way of knowing them in advance; he may well fail to heed them even if he supposes he knows them. It is, therefore, entirely sound to establish in the curriculum a general order which, on the whole, assures logical progression. If at the same time the student's entire time is not requisitioned, he can still indulge in blunders or vagaries enough to teach him the folly of illogicality on the one hand, or the wholesomeness of heterodoxy on the other—both being important lessons, for him as for his teachers.

V

The subject titles under which the medical curriculum is usually presented are chemistry, physics, sometimes botany, zoölogy, and biology; anatomy, physiology, biochemistry, pharmacology, bacteriology, pathology, hygiene; medicine, surgery, obstetrics, and an indefinite number of specialties. Under favorable circumstances, specialized opportunities in some subject or other form part of the undergraduate curriculum. Thus, physical chemistry may be added to the basic sciences, serology or immunology to the medical sciences, pediatrics and syphilology to the clinical studies. Curiously enough, despite the increasing importance of preventive medicine consequent upon the advance of bacteriology and the clearer knowledge of the futility or limitations of many therapeutic measures, hygiene continues to occupy a decidedly subordinate position in the undergraduate curriculum; and even incidental treatment of

the preventive aspects of disease, though increasingly common, is still far from general.

The remainder of the present chapter will be devoted to description and criticism of curricula from the point of view above set forth; in the following chapters we shall discuss the method and spirit of the instruction.

VI

In France the student enters the clinic immediately on beginning the study of medicine at the faculty. Simultaneously he starts dissection, giving the afternoons of the first year to that work. But it is the characteristic feature of the French curriculum, that, without previous knowledge of the structure and functioning of the body in health, the student is sent into the wards, where he is at once set to examining patients, taking histories, undergoing cross examination at the bedside in the presence of his fellows, and listening to the clinical exposition of his professor. Such importance is indeed attached in France to immediate induction into general clinical work that the professor himself teaches by preference first year students, of whom, at Paris, from fifty to a hundred follow him through the wards.

The medical course is planned to occupy five years; but as we shall see, it holds together so loosely that the student often consumes six, seven, or more, and it is precisely the abler who, as a rule, proceed the more slowly. A notion of the theoretical arrangement may be conveyed by the table opposite, put forward by the Paris faculty as a suggestion to students, though not binding on them.

The student therefore practically completes two-thirds of his required attendance on general medical and surgical clinics during his study of anatomy and physiology, and prior to the study at the faculty of bacteriology and pathology.[9] As a

[9] We shall, however, see (pp. 245 ff.) that the clinical teachers do not wait for this theoretical instruction; informal classes, aiming to fill the gap, are formed in the hospitals.

	Mornings	Afternoons
1st year	Clinics in Medicine and Surgery	Winter —Anatomy Summer—Histology and Physiology
2nd year	Clinics in Medicine and Surgery	Winter —Anatomy Summer—Histology, Physiology, Chemistry
3rd year	Clinics in Medicine, Surgery, and Obstetrics	Winter —Bacteriology, Pathology Summer—Operative Surgery, Parasitology, Pathology
4th year	Clinics in Specialties	Winter —Pathology Summer—Materia Medica and Pharmacology
5th year	Clinics in Pediatrics, Infectious Diseases, etc.	Winter —Neurology, Hygiene Summer—Psychiatry, Legal Medicine

matter of practice, however, throughout his course, he sandwiches in attendance on one or another clinic in medicine and surgery; so that sooner or later medicine and surgery will be expounded to young men and women who have received some training in pathology and bacteriology. The same clinical exposition will thus be addressed to a group, some of whom are in position to understand the pathology and etiology of the case, while others are assailed by a terminology which is more familiar than intelligible. A certain confusion inevitably results.

Subject mainly to the constraints of the examination ordinances,[10] students are to a large extent free to modify the order suggested by the faculty. But the universal arrangement which places all laboratory work in the afternoon deprives them of opportunity to lay a foundation before beginning their clinical studies, even if they so desired. The clinics are securely entrenched in the fresh morning hours and the laboratories are empty until afternoon; under these conditions even anatomy

[10] These are briefly described in Bulletin No. VI, Carnegie Foundation for the Advancement of Teaching (New York, 1912), p. 286, and have undergone no substantial modification in recent years.

and physiology wear an incidental aspect which nothing in the entire course of study is calculated to remove.

The French curriculum is therefore a curriculum based upon the priority and predominance of the clinical subjects throughout; the method is in effect the apprenticeship or "natural" method. The student gets his impressions of health and disease quite higgledy-piggledy; gradually, as he reads his textbooks, listens to lectures, follows the clinics, and acquires concurrently some knowledge of normal anatomy and physiology, his ideas settle into a kind of order. It must, however, be a long time before anything like definite system prevails; until clear pictures of normal and abnormal oppose themselves to one another in his mind; until terms which he has heard lightly bandied by the professor and in the use of which he has himself become glib are to him something more than mere words; until knowledge and technique acquired at the middle of his course succeed in inserting themselves in his mind and practice underneath the clinical experience through part of which he has already passed.

A rare clinician in France—usually one who knows Germany or the United States—and, somewhat more frequently, a pre-clinical scientist may criticise the French system on the ground that in the earlier years attendance on the clinics is wasteful and demoralizing.[11] But more frequently the system is defended by clinicians and sometimes even by the laboratory scientists, who aver that the student will not be interested in anatomy and physiology unless he is concurrently made aware of their clinical bearings. The argument has a strange ring in France. Throughout his previous years in the *collège* or *lycée* his preferences were but slightly considered; he was required for years to study classics and mathematics, not because he was interested, but because the authorities thought they were good for him. One would suppose that the medical faculty would be similarly free to arrange his studies in the general order that is best for him. I cannot but feel that the real explanation of

[11] See chapter X, pp. 253 ff.

the French curriculum is to be sought in the domination of the hospital and the clinician—that the arrangement was not adopted and is not continued because of consideration for the student's point of view.

Two great advantages of the French curriculum must, however, be pointed out: it is in a high degree flexible; it throws upon the student himself a heavy responsibility for his own course. Though certain laboratory requirements, technically called "inscriptions," must be met as prerequisites to hospital appointments, students pursue their clinical studies and the practical courses connected therewith in different orders and under different conditions, varying their arrangements to meet their taste, convenience, and abilities. They are largely free to select their own masters, in consequence of which popular teachers are occasionally men who hold no university appointments. The student is treated like a man, not like a schoolboy; enforced regimentation ends with the *lycée* and the *collège,* as it should. Thenceforth he is largely master of his own fate. Whether the conditions in respect to equipment, opportunities and ideals are correspondingly sound, we shall have occasion to inquire later.[12]

VII

The English medical school [13] began, like the French, in the hospital wards on the clinical or apprenticeship basis; but it has, in recent years, progressively undergone reorganization until it has become, in point of theory, of the logical type. If, so the British now argue, the student is to recognize disease, it is futile for him to approach the patient without a conception of the body in health. Inasmuch as modern science has created a picture of the normal body in its actual functioning, why should the student of medicine confusedly follow a procedure that antedates modern physiology? The latest step

[12] See e.g. pp. 244 ff.

[13] Not, as has already been pointed out, the Oxford and Cambridge schools.

in a series of reforms, therefore, organizes the British medical curriculum on the "block" system—i.e., the student cannot enter the medical school and begin anatomy and physiology without previous study of chemistry and physics; nor, once in the medical school, can he gain credit in the clinical subjects until he has successfully passed all the required work in anatomy and physiology. The makers of the current curriculum had two objects in view. First, they realized the importance of approaching the study of disease from the standpoint of normality. The "block" device procures this advantage for the student by giving him two years of training in the medical sciences. Second, inasmuch as most British students still pass from school to practice, without an intervening "practical" year or internship, such clinical training as is procurable in three years should not be hampered by division of the student's attention. The general arrangement has up to recently been as follows, though the five years sometimes became six or even more:

1st year:	Chemistry, physics, zoölogy.
2nd year:	Anatomy, physiology.
3rd year:	Winter—anatomy, physiology, materia medica. Summer—pathology, medicine, surgery.
4th and 5th years:	Clinical subjects in different orders.

The curriculum in Great Britain is, however, now planned on the basis of six years' study of which two and a half are to be devoted to the medical sciences and three and a half to the clinical subjects. Between the two, the General Medical Council advises that a bridge be constructed by means of brief courses in case-taking, physical diagnosis, and general pathology towards the close of the third year.[14] The recommendation, logical and sensible, as it is, merely regularizes what was already becoming common practice. Distinctly questionable,

[14] At Sheffield, Manchester, etc., a partial additional block is introduced in the form of a separate examination in pathology and pharmacology separate from and prior to the clinical examinations; but the student who fails in one of the two subjects is not checked in his career.

as we shall later see,[15] is the suggestion contained in the recent recommendations of the General Medical Council that, during the already heavily burdened clinical years, the study of the underlying sciences should be renewed or reviewed—physics, chemistry, biology, anatomy, and physiology—through the provision of courses emphasizing "their applications to practice."

I have pointed out the fundamental soundness of arrangement of the British curriculum. It is important to draw attention to another feature, viz., a certain measure of flexibility in respect to both length and order of subjects within the respective blocks. In the first place, students enter, not all together in the autumn, as in America, but at different dates—in October, January, and May. The minimum curriculum ran, under the arrangement just in process of being superseded, five years. Yet at Guy's for example—and the same thing occurs commonly—in two representative years, less than half the classes in question "qualified" (i.e., completed their course) in the prescribed period; the rest scattered, remaining for periods running from three months to two years beyond the minimum. At Glasgow, of a given class containing 288 students, 25 per cent. remained beyond the average period of study of the entire group; less than half completed the course in the minimum period prescribed. Of those who thus tarry, some are, of course, dull and slow, seeking, like those who finish in the minimum period, only the minimum qualification upon which they may practise; but others, who stay longer, are of the opposite type, viz., the ablest, who aim at the higher distinction represented by a university degree or a membership in the Royal College of Physicians.[16] Thus a certain amount of "re-shuffling" is constantly taking place in the student body. On the other hand, a characteristic defect must be pointed out, towards the removal of which some effort is now being directed: the honors student, whether in the academic

[15] See pp. 242-3.

[16] The ordinary qualification is that of the so-called Conjoint Board. See Carnegie Bulletin VI, pp. 268, etc.

or the professional field, undertakes more than the ordinary student; but as he still demonstrates his achievement by means of a conventional examination, his exertions keep him within the field of the already known. He learns a great deal—much on his own initiative; but too little value is attached to originality.

Flexibility varies from place to place. At Cambridge, for example, the ablest students, deliberately selected, are encouraged to lengthen the period of their studies by a year, in order to win honors especially in physiology.[17] The amount of anatomy, physiology, and biochemistry they take and the time they spend are all subject to large variations—depending, to quote a Cambridge don, "on their ability and the kind of advice they get." In the London hospital schools, opportunities and facilities on the laboratory side being more limited, there is little choice on the part of the student as to what things he will do or as to the order in which he will do them.[18] But on the clinical side, the number of separate certificates, appointments, or examinations involved is somewhat portentous. Inasmuch as the number of appointments in every subject is at a given moment small, uniformity of order is impossible.[19] Students who have been variously occupied in preceding terms find themselves working side by side. To the extent that their experience has been different, a decidedly wholesome situation results. Moreover, they stay longer or shorter periods in this subject or that, according as their aim is one or the other of the qualifications which I have just mentioned. Finally, control is less mechanical and rigid than in America, exercised as

[17] The same holds of Oxford, where, however, the number of medical students is small.

[18] Moreover, the London schools, overwhelmingly practical in object, have never made a point of that personal cultivation of the able student, which is the very essence of the Oxford and Cambridge honors system. The consultant-teacher has not the time, and, moreover, leads a totally different kind of life from that of the university don. The heads of the units are, however, hopeful that they may succeed in developing a type of honors student.

[19] I allude here to the system of clerkships and dresserships described in connection with clinical teaching. See p. 240.

it is mostly through sets of comprehensive examinations given by outsiders at intervals of two years, rather than by a fixed schedule with its definite "courses," each terminated by its appropriate examination, conducted by the instructors themselves, as in America.

There are, to be sure, factors that work in precisely the opposite direction—for example, the clannishness of the London hospital schools, which produces a somewhat tepid variety of American college loyalty, and the tutorial grind, which trains groups of students for one or the other of the several possible qualifications, the particular scope of which is a matter of expert knowledge. These factors offset in greater or less degree the merits on which I have dwelt. None the less the potential variety and elasticity of the arrangements, subject to the underlying principle of general order, are distinct and meritorious features of the British curriculum.

VIII

In Germany, Belgium, Switzerland, and Denmark a more or less modified form of the block arrangement is in vogue. The basic sciences, already begun in the secondary school, are reviewed and extended during the early semesters; but simultaneously the student begins anatomy and physiology—the basic sciences and the medical sciences overlapping, the former receding as the latter take a larger place in the program. Thus in Germany 2 years (4 semesters), in Switzerland 2½ years (5 semesters), in Belgium 2 years, in Denmark 3½ years (7 semesters) are consumed. Pathology, the clinical branches, hygiene and legal medicine occupy the latter years—at least 2½ years (5 semesters) in Germany, 3 years (6 semesters) in Switzerland, 3 years in Belgium, 3½ years (7 semesters) in Denmark and 5 semesters in Holland.[20] The same over-

[20] Both in Great Britain and on the continent the length of the term or semester varies, both nominally and actually. In appearance, the holidays are lengthy; but they are meant, for both teachers and students, as

lapping appears. But pathology, physical diagnosis, and an introductory, or as it is often called, a propædeutic clinic are usually more prominent in the first clinical semester, bridging the gap between laboratory and clinical work. Meanwhile, started in almost every conceivable order, pathology and the main clinical subjects reappear in several semesters—sometimes successively, sometimes after an interval.

The following table shows the order suggested by a German faculty:[21]

1st semester:	Osteology, zoölogy, physics, chemistry.
2nd semester:	Anatomy, physics, chemistry, botany.
3rd semester:	Anatomy, histology, physiology, chemistry.
4th semester:	Anatomy, physiology, physiological chemistry.

Examination in basic and pre-clinical sciences.[22]

periods for reading and study as well as physical recreation. As such they are employed by the serious, for whose benefit the arrangement was made and is retained. For example, at Cambridge, university courses in elementary pathology and bacteriology are offered during the "long vacation"; they are commonly attended by men who have just taken the B. A. degree, before they go up to London for their clinical work.

[21] One speaks of the German, Swiss, Danish or other "plan of studies"; as a matter of fact, the student's course is determined not so much by the plan of studies suggested by the faculty as by the details of the examination ordinances of the respective countries. In general the two coincide, with, however, this difference—that the plan suggested by the faculty includes certain subjects in which separate examinations are not given. The student necessarily takes into consideration the question as to whether or not he is to be examined in a particular subject. But even this consideration is not itself final: for an examiner in physiology or medicine might ask questions that would naturally belong to pharmacology. Again, regardless of both plan of studies and examination ordinances, able and interested students branch off and do work that is not either required or suggested. The flexibility of continental training is therefore genuine and for this reason no description can be entirely adequate. I have, therefore, tried to indicate the way it works rather than to describe lifelessly either faculty plans or examination ordinances.

[22] A student who fails is reëxamined six weeks later; should he fail a second time, he has heretofore been examined again. Practically no one was permitted to fail the third time. At the worst, a semester is thus lost. The new regulations permit only one reëxamination, in order that incompetents may be actually rejected.

5th semester: Anatomy, physiology, physical chemistry.
6th semester: Pathology—general, special, and experimental; auscultation and percussion; pharmacology; propædeutic medical clinic and general surgical clinic.
7th semester: Pathology, auscultation and percussion, clinical microscopy; medical, surgical, and obstetrical clinics and lectures.
8th semester: Pathological anatomy and histology; medical, surgical, obstetrical clinics; lectures in psychiatry.
9th semester: Medical, surgical, obstetrical, psychiatric, pediatric, and special clinics; hygiene, serology.
10th semester: Special clinics; hygiene; legal medicine.
Final examinations followed by practical year.

In essence, subject to a few minor qualifications, a similar arrangement obtains throughout Western Europe except France, already discussed, and Holland and Sweden, to be considered later. It is interesting and significant to observe that, despite the prestige of France in French-speaking Belgium and French-speaking Switzerland, both the latter have adopted the logical instead of the "natural" type of curriculum.

The continental scheme allows great variety of arrangement within both the laboratory and the clinical divisions. The British student takes his clinical subjects in one order or another, partly because the number of students (clerks or dressers) who can be accommodated in the wards at any one moment is restricted, partly because he is free to spend longer or shorter periods in different subjects. The continental student, whose training is, as we shall see, far too largely demonstrative, enjoys greater freedom as respects the number of lectures he attends or the fashion in which he combines them. Thus, students pursue their subjects in no uniform order and devote varying amounts of time, above a prescribed minimum, which is itself not very strictly controlled.

The overlapping and repetition, characteristic of the continental curriculum, are partly ascribable to the methods of training employed. The student is expected to learn largely through listening and looking on.[23] Finding that he learns little by listening and looking once or twice, he listens and looks time and again; but the number of subjects in which he is to be examined, or in which he is interested, is great; hence, repeated attendance at lectures and clinics fills his day to the brim. A comparison of individual course books with the official curriculum shows that the student takes both less and more than is suggested. Two semesters each of physics, chemistry, and one of botany and zoölogy are commended. The examination certificates must show enrollment in two semesters each in medicine and surgery; the faculties usually urge three; the record books frequently show more than three and the student at times attends more or less faithfully even more. The possible combinations range thus from the fairly simple and coherent to the utterly absurd. As an example of the latter, readily paralleled, the following transcript of the course book of a Freiburg student in his ninth semester may be cited:

Obstetrical clinic and polyclinic (also in 6th, 7th, 8th, and 10th semesters).
Medical clinic (also in 8th and 10th semesters).
Surgical clinic (also in 7th, 8th, and 10th semesters).
Psychiatric clinic (also in 7th and 8th semesters).
Practical bacteriology (also in 7th and 8th semesters).
Pharmacology (also in 7th and 8th semesters).
Otology.
Ear clinic.
Ear polyclinic.
Skin clinic.
Legal medicine.
Medical polyclinic (also in 10th semester).
Pathological physiology (also in 8th semester).
History of medicine.

[23] See pp. 249, 251, etc.

Topographical anatomy.
Autopsy course (also in 8th semester).
Pediatric clinic.
Infant nutrition.
Infant care.
Nose and throat clinic.
Hygiene (also in 8th and 10th semesters).
Protozoölogy (also in 7th semester).

Absurdities like the above partly cure themselves, for the facts do not bear out the record in the course book. The student makes a brave dash, listening for a few days to a steady stream of lectures, which, one by one, he drops. In the course of a few weeks, he has concentrated on the practical courses, at which his attendance is to some extent "controlled," and such lecture courses as are of particular interest or importance. Among the lecture courses, which are often ignored, are many for which a certificate of attendance is required; the student pays his fees, attends once or twice, obtains the lecturer's signature, and absents himself thereafter, if he so chooses. He is, of course, more apt to attend if the course is one in which an examination is held; but even in respect to these, if the lecturer is inferior in power, attendance is ragged. On the other hand, the auditorium of an able man is thronged with students, regardless of official suggestions or examination requirements.

The virtues of the continental curriculum [24] appeal strongly to the American observer. The student enjoys a large measure of freedom and responsibility. He may within limits make his own combinations; he has every inducement to exceed the required minimum at any point at which his interest has been aroused; and the better do. Moreover, students do not usually construct for themselves identical curricula; they have not had precisely the same experience, nor do they know precisely the same things. Their ideas are bound to clash; they thus

[24] I am speaking here, as throughout the chapter, of the principles of curriculum-making, not of methods of teaching. The latter subject is discussed in Chapters VIII and X.

instruct and stimulate one another. In the end, the examinations may be so ordered—such is not always the case—that the student is indirectly preserved against running too wild. In any event, elasticity which at times deteriorates into chaos is on the whole preferable to a lock step which keeps able and unable, energetic and industrious, clamped within the same form, practically without individual responsibility.

Critical Germans are, however, at the moment perhaps more conscious of the defects than of the merits of their university curriculum. These defects are to a very considerable extent protected by the peculiar organization of the German faculty. The organization is, as I have pointed out, distinctly aristocratic—a small and very slowly increasing group of full professors (*Ordinarii*) controlling the situation. The *Ordinarius* derives his income in part from student fees.[25] The more students he has, the greater his income. The required courses are therefore mainly those given by the *Ordinarii*. Meanwhile, especially on the clinical side, the required lecture courses are not necessarily those which are most valuable to the student—important as it is for him to see and learn the technique of a master in diagnostic exposition. Practical courses, such as must be given to small groups, would not pay the *Ordinarii*. They are therefore left to assistants and *Privat-Docents;* and the student arranges for them as his purse, time, and inclination permit. The evils that result from unfair emphasis as between lectures and practical courses, from confusion resulting from absurdly arranged and often overburdened schedules have led certain recent reformers [26] to urge something like the American plan—a systematized schedule, the same at

[25] The share of the fees paid to professors has been decreased in recent years and a lively controversy rages on the whole subject. For the two sides, see Becker, loc. cit., pp. 58 ff., and Lubarsch, loc. cit., pp. 60 ff.

[26] For example, Professor Bernhard Fischer of Frankfurt a. M. in his *Zur Neuordnung des medizinischen Studiums und Prüfungswesens* (München, 1919). Its contents are summarized in an article by Professor Fischer in the Berliner Klinischen Wochenschrift, 1919, No. 49, pp. 1158 ff. For a more moderate view see Schwalbe, loc. cit., pp. 54-55, 64 ff., 72 ff.

all universities, containing the essential subjects and specifying the maximum number of hours that can be required in each: "The curriculum," declares Fischer, "must guarantee the training of the practical doctor without gaps. It must embrace all the lectures (*Vorlesungen*) unconditionally necessary to attain this end."[27] The proposed remedy would be worse than the disease, for uniform, schematic arrangements are very deceptive: on paper, students seem to be getting, and instructors seem to be teaching a uniform minimum; but different teachers continue to do different things, despite the common heading, and students draw varied benefits from the same instruction. The results therefore, are infinitely various, no matter how much effort is expended in making the time schedules look alike. Again, the lengthening of the curriculum has been suggested —more lectures, more demonstrations—an aggravation, ininstead of a cure.[28] One suspects that less drastic measures would alleviate the evils, without destroying the virtues, of university education. If proper emphasis were laid upon practical, as against demonstrative or theoretical instruction, many of the huge lecture classes would disintegrate and some form of organization would inevitably come about. A different problem would at once arise—the problem of preserving elasticity and flexibility enough—for the freedom of the student, however abused, is the most precious element in university life on the continent.

In respect to general arrangement, the Austrian, Swiss, Dutch,[29] and Belgian curricula do not differ essentially from the German curriculum. They begin with the basic sciences and anatomy; thereafter they devote a few semesters to anat-

[27] Loc. cit., p. 13. Those who make the suggestion do not really understand the American system. See pp. 137-8. Could there be better proof of the importance of looking abroad before taking a leap?

[28] Schwalbe, loc. cit., pp. 54-55.

[29] The Dutch universities give the student only the most general information regarding the order in which subjects should be pursued; yet the Dutch student, characterized by his teachers as usually docile and industrious, follows a beaten path with great conscientiousness.

omy, physiology, and chemistry, at the close of which an examination takes place. The concluding semesters, approximately five in theory, usually more in practice, are devoted to the clinical subjects, which the student pursues in much the same fashion as obtains in Germany.

Denmark differs slightly, though not essentially. Three "blocks" divide the course into four sections: (1) physics and chemistry, which occupy one year; (2) anatomy and physiology, four or five semesters (2-2½ years), next; (3) pharmacology, general pathology, and pathological anatomy, usually, but by no means always, consuming five semesters; and (4) the final year devoted to the clinical subjects. The arrangement just described conveys, however, an incorrect notion of the amount of time given to clinical study. During the first year of study, the Danish, like the French student, attends the wards; unlike the French student, however, having just tasted clinical blood, he drops out of the clinics during the semesters devoted to anatomy and physiology. Clinical work of different types is resumed during the four or five semesters devoted to pharmacology and pathology; groups of students make their own arrangements with the assistants on the clinical staff for instruction in physical diagnosis; again, the students in groups attend the clinics either at the university hospital or the communal hospital. Clinical study during this period is voluntary, but is—and must be—generally followed. During the final year, expressly set apart for clinical teaching, instruction is, as we shall later see,[30] concentrated, intense, and varied.

IX

The Swedish curriculum differs markedly from the curricula already described. It falls into two parts—the first, including pathology, bacteriology, and pharmacology with anatomy and physiology; the second, comprising the clinical branches, legal medicine, and special pathology. The laboratory branches

[30] See pp. 262-3.

proceed logically. Subject to individual variations, not forbidden or uncommon, an arrangement such as the following would be quite typical:

First Year: Anatomy, chemistry.
Second Year: Physiology, histology, biochemistry.
Third Year: Pathology, bacteriology, pharmacology.

On the clinical side the departures are more marked. For, as contrasted with the hodgepodge often encountered in Germany, the Swedish scheme concentrates the student's attention as nearly as possible on one branch at a time. Thus, a half-year is devoted to medicine, the next semester to surgery, the next to obstetrics. The thorough study of patients undoubtedly brings physiology, pathology, and bacteriology into the successive clinical subjects, just as surgery and obstetrics to some extent renew the student's contact with internal medicine. One cannot, however, resist the feeling that for most students concentration so intense and so discontinuous may not be economical of time. A beginner in medicine cannot well spend all his working hours over a few patients; he has more time than he can thus dispose of. The best students of course read, or begin a piece of minor research. But the temptation to waste time or to engage in some outside occupation is strong.

I have pointed out that continental curricula as planned vary considerably in length. Though the student body is of approximately the same quality in respect to age, maturity, and general education, the medical curriculum varies from a minimum of five or six years[31] to a maximum of eight or more years; in Sweden the course, sometimes interrupted by professional service in the country districts, may last eight, ten or twelve years. Thus within each country, great individual variations occur. We shall see later that the course and term examinations, which clinch the class organization in

[31] According as a year of science is included or not. The hospital year, required in Germany, is not included in the figures given in the text.

America, are largely unknown in Europe.[32] Examinations, oral and practical, go on almost continuously through the school year. Subject to minimum time requirements, the student is free to present himself for examination in one of the two or three fixed groups of subjects, whenever, in his own judgment, he is ready. His little account book must show that he has registered for certain required lectures (no one knows whether or not he has regularly attended them), that he has attended the required practical courses, and that the minimum number of semesters has elapsed. It happens occasionally that a student will thus go through on schedule time —but only occasionally. For almost all students do more than is required, or study longer than the scheduled time.

[32] At Edinburgh, students are required to obtain class certificates of proficiency, before they enter the professional examinations, which cover an entire subject. Term examinations are also in vogue, as in America. The Edinburgh curriculum resembles the American in respect to lack of flexibility.

CHAPTER VI

CURRICULUM

B—AMERICA

I

The medical curriculum in the United States is of the logical type.[1] The order in which subjects are presented is sound. Physics, chemistry, and biology are regarded as basic, not as medical sciences, and are therefore studied in the secondary school and college, without specific reference to medicine. The medical subjects themselves are in principle—slight variations in detail occur—presented in the following order:

1st year: Anatomy, physiology, physiological chemistry.
2nd year: Physiology, bacteriology, pathology, pharmacology, physical diagnosis.
3rd year: Obstetrics, medicine, surgery, clinical microscopy, pathology.
4th year: Medicine and surgery, including clerkships, specialties, etc.

[1] I do not include the internship, lasting one or two years, as part of the medical curriculum as such, though it is rapidly becoming an accepted factor in the physician's training. If the internship were included, the medical course would have to be estimated as requiring five or six years, according as the internship fills one or two years. In effect, the internship introduces a certain variety at the close of the student's training, since graduating classes scatter to take internships, and the opportunities of the intern vary from one hospital to another. I shall have occasion later to call attention to the fact that the increasing vogue of the internship makes it possible to change in certain particulars the character of instruction now given in the clinical years: for example, the acquisition of practical skill in the specialties may be to some extent, at least, postponed from the undergraduate to the intern years.

Thus, the normal precedes the abnormal, and an effort is made towards the close of the second year to bridge the gap between the laboratory and the clinical subjects.

To this general order an exception should perhaps be instanced. In a few schools, an effort is being made to show in the early years the clinical bearing of anatomy, physiology, and biochemistry by exhibiting perhaps once a week patients who illustrate clinically the conditions which the student is studying in the laboratory. The procedure differs, though not in intent, from the clerkship described as existing in Denmark. Inasmuch as I shall return to the general problem involved in discussing aims and methods of teaching, at present I record the fact merely as a slight curricular innovation.

We have found that in Europe the actual length of the curriculum is not usually the same as the scheduled length. In America the two coincide. A few students are dropped, mainly during the first and second years; a few transfer—the weaker to less exacting schools, the abler to stronger institutions. Practically all the others pass through the medical school shoulder to shoulder, phalanx-fashion, the classes being clamped together and kept apart by term and annual examinations to which the students must all alike submit at the appointed time. A student who chose not to appear would be guilty of insubordination or would confess failure. Thus, in 1914, out of a graduating class of 67 at the College of Physicians and Surgeons, New York, 9 were one year retarded, all on account of failure, which they thus retrieved—none in order to do more or different work; at the Johns Hopkins Medical School in the same year, 90 out of 91 members were graduated on scheduled time, and the remaining one, belated by a failure in one course, received his degree the following January; at Harvard, out of a graduating class of 64, 2 required more than four years on account of poor scholarship, and only one student took more than the required amount of work—he taking in the fourth year nine months' work, when only eight were compulsory. As recently as 1923, of a graduating class of over one hundred

at one of the outstanding university schools of medicine, only two appeared "out of course"—i.e., out of the regular class organization. Thus practically all students, good and bad, able and ordinary, complete the medical course in the same length of time. Abroad, as I have repeatedly shown, a student who becomes enamored of physiology or pathology may stop in order to devote an extra year to advanced work. In America, delay, if it occurs, is so obviously due to failure that the College of Physicians and Surgeons, New York, forbids any student "to take more than five years in which to obtain his degree." [2]

II

Within the four-year curricula, unfortunate as such uniformity is, certain significant and hopeful differences exist. There were in the United States, at the most recent count, 80 medical schools, which in June, 1922, graduated 2,529 doctors of medicine. Of these 1,700—approximately 70 per cent.—obtained their education in some sixty-odd institutions, varying but slightly from one another, through each of which during four years they moved in lock step. They were grouped in fixed classes, the personnel of which was practically unchanged, except for outright losses due to failure, from year to year; they followed in fixed order, day by day, the same subjects, for the same length of time, in the same year and at the same hour. From 8:30 to 1, from 2 to 4:30, all students in their respective classes pursued an identical routine. And, at regular intervals, all alike, in the same rigid groups, performed precisely the same practical exercises, attended the same quizzes [3] and submitted to the same monthly, semi-annual, and annual examinations. Anything more alien to the spirit of scientific or modern medicine or to university life

[2] The tripos at Cambridge is, as I have pointed out, limited to three years; but this is a race, a competition, and the limitation in time is set up for the purpose of selecting winners under given conditions.

[3] Here a variation should be noted. Private drill or cram groups are formed in America as abroad to prepare for examinations.

could hardly be contrived. We have seen that it is impossible to set aside any definite set of facts or skills as constituting the "best" training for medicine. Medicine is scientific, if at all, mainly because of an attitude and technique. With certain obvious exceptions, the particular facts learned, the particular skills acquired, are of less importance than the habit of inquiry, the ability to use the senses, the capacity for well-directed effort. These cannot be acquired in the same fashion by all students, any more than they can be acquired in the same time or to the same degree. The curricula of these sixty-odd schools are constructed and administered on the assumption that the definite items that constitute medical education can be formulated, combined, and in a fixed period communicated to the members of a group that hardly changes from year to year.

Between the spirit of the instruction in these schools—practical and uninspiring—and the spirit of the remaining schools—a dozen, more or less—which in June, 1922, graduated 800 doctors, there is a marked difference—a difference that is far greater than one would guess from a mere inspection of the time-card. The small group of schools of which we are now speaking get a certain degree of variety within each of the four years—the classes, alas, are still held together year by year—in two ways; first, by the introduction of "electives," that is, the opportunity to make a choice—usually compulsory—between courses sometimes dealing with one aspect rather than another of the same subject, and sometimes dealing with different subjects, but all estimated to demand about the same amount of time and effort; second, by the introduction of really voluntary courses or opportunities, which the student may take or not, as he pleases. Election of the compulsory type—that is, the chance to choose from several courses, is more highly developed than the unqualified opportunity to elect something or nothing, according as the student has time, ability, and inclination.[4] For, though the student is thus en-

[4] Yale has, for example, reduced the amount required of all students alike by 1,000 hours; but the student *must* "elect 60 per cent. of this time during

abled to depart at certain points from the otherwise fixed type, even these variations come at fixed—and rare—hours and are so nicely weighed that, as far as administrative ingenuity can have its way, the demand made upon the student's time and effort remains practically uniform. A student may once or twice a week thus succeed in doing a different task from some of his fellows; but no chance is run that he should be busy while they are not officially occupied, or that he should be officially required to put forth an ounce of energy, more or less, than is simultaneously required of all the rest.

A few schools, however, allow greater latitude, even then, with the single exception of the University of Chicago, retaining rigidly the four-year organization. At Johns Hopkins, for example, two afternoons a week are free for elective work, which the student is free to take or omit, as he pleases; in the fourth year, the student body divides into small groups, which, subject to certain general requirements, range over the whole clinical field. Yale allows no freedom in the first year; in the remaining three, half of the electives are of the compulsory type. Beyond this requirement, students are free to work in any department, the head of which is willing to admit them. Harvard in the final year requires courses that fill six and a half months; it leaves one and a half months free for elective work. In addition, by a recent regulation, "Tuesday and Thursday afternoons are left free for second- and third-year students *to take or not,* as they please, certain Voluntary Courses. It is believed that upper-classmen will welcome a chance to keep in touch with the most recent developments in the fundamental sciences; that an interest in certain fundamental subjects will have been aroused by their clinical work; or that they may feel the desire for additional training on some point. Students are not required or even asked to take these courses; it is entirely a voluntary matter, and no credit will be

his second, third, and fourth years; in the second and third years he can elect work in one department only, in the fourth year, in two departments."

given."[5] Thus, really capable students may, if tenacious, obtain an introduction into the technique and spirit of research. In this matter, the personality of the instructor and the spirit of the department are decisive; for, despite usual gravitation towards the clinical side, a fertile anatomist, physiologist, or pathologist will often attach the ablest pupils to the opportunities available in the pre-clincal sciences.

The arrangements just described result in a curious mixture of school and university: the school spirit manifests itself in strict maintenance of the four-year schedule, and in the clockwork regularity with which at uniform hours on uniform days entire classes may, as it were, "take the air," each student in his own way, provided a proper person first approve the way; the university spirit displays itself in the advanced character of the opportunities offered, some of which include independent work on a small problem or participation in some important research—opportunities such as are not often open to undergraduate students abroad. Limitations upon the student's choice due to limitation of facilities or of staff are, of course, inevitable and are indeed desirable; no university professor should be at the mercy of students; the professor should always be in position to determine whom he will admit to advanced opportunities and on what terms; but in so far as restrictions upon the student's freedom are due to the mere administrative need of putting every student through his paces within four years, assuredly other than university criteria determine procedure.

Somewhat greater elasticity than elsewhere exists at the University of Chicago, partly because of the four-quarter system, partly because certain students work for other than the M. D. degree, partly because there as elsewhere a few students elect more than the minimum requirement. In the first and second years, the student's leeway is, however, very slight,

[5] The term "courses" is an unfortunate misnomer: "We want to make them less courses and more opportunities to work," writes the Dean in a private letter.

amounting only to one-ninth of the minimum requirement. Of sixty-five students of medicine entering the university October, 1918, twenty-four dropped out, eighteen received their degree on the minimum basis, sixteen exceeded the minimum requirements, and nine were still candidates for the degree after an interval of five and a half years. In all probability these were among the abler students, since the weaker were necessarily those who disappeared early.

III

The amount of time actually scheduled, is, however, so large, and, in most schools, the control is so "efficient," that the student's opportunities to pursue even a small part of his studies in this manner and spirit are meager. The peak appears to be reached by the College of Medical Evangelists in California which schedules 4,896 hours of instruction, an average of 1,200 hours annually; the University of California with 4,744 is not far behind; the College of Physicians and Surgeons, Columbia University, New York, requires 4,361 hours. Even institutions which have developed elective and optional courses make so heavy a requirement that scope for free play is necessarily very limited. Yale, for example, after cutting over 1,000 required hours from its schedule, still requires a total of 3,972 hours during the four years; Johns Hopkins is somewhat better, requiring 3,544 hours, while offering electives that total 1,586 hours.[6] A student staggering under such a burden cannot, except sporadically, stop to read, work, or think at random. Thus the profession, in which least depends on mere "learning lessons" and most on initiative and interest, carries on its training without reference to the development of independence and resourcefulness. In this matter Harvard has recently taken a decided step forward, for

[6] At Stanford University also certain periods in the first and second years are specified as free "in order to keep the student from overloading his schedule."

it has reduced the required hours during the first three years by something more than 33 1-3 per cent. Thus the able student may do more, and the conscientious student of moderate ability may at least escape from a breathless and unremitting grind. The inferior student, who had by main force to be held with his nose to the grindstone and in whose interest the American curriculum was invented, is very properly left more largely —though still not largely enough—to his own devices. Inasmuch as voluntary and individualized effort is more highly educative than conscientious performance of stereotyped tasks, the entire schedule should be so contrived that the able student may have time in which to develop himself, while the mediocre student plods along under reduced pressure, and the incompetent student, if he so pleases, sits idle, doing nothing.

Apart from our characteristic national fondness for organization as such, the common American medical curriculum is in part accounted for by the inferiority of the usual high school and college, and the poor medical school. A student who has not learned to apply himself intellectually is not prepared to pursue university studies; the medical school, intent upon the production of doctors, thinks to accomplish its purpose by employing belated methods of discipline, however repugnant to its spirit. The desire to stamp out unfit medical schools has also operated to strengthen regimentation. The proprietary medical school offered its students a single set of lectures in each of half-a-dozen subjects which they were required to attend during two successive sessions. To break up this parrot-like repetition, laws were procured requiring institutions to provide a "graded" course, first three, and later four, years in length. Our present fetters were therefore forged in order to compel wretched medical schools to give unfit medical students a "better" training. Now that that end has been measurably accomplished the means have become a fetich, blocking further improvement. Meanwhile, college "class spirit" has invaded the university medical school. Factitious importance attaches to the maintenance of the class organization; those who begin

together must go out together—the mere accident of entering together thus uniting persons who might otherwise be quite indifferent to one another. A student who entered an American medical school with the "class of 1922" would, generally speaking, be a homeless waif if, interested in physiology, he paused for a year and thus had, the next year, to domesticate himself with the "class of 1923." Largely for the same reason, viz., class and institutional "spirit," American students rarely migrate, though the graded curriculum ought to facilitate migration; but then migration would destroy the clannishness which the American college and university so highly value: it would be "disloyal"!

The consequences of rigid class organization and school "spirit" are far-reaching. I have shown how the student is thus deprived of initiative; but the teacher is also damaged, for he is protected against competition. The German, French or Swiss teacher of medicine must *attract* [7] students—he must therefore win a name as an able teacher, and in the Germanic countries as a successful investigator. The pupils of the American professor come to him as a matter of course, except in so far as a few schools allow really free election here and there. A teacher may be able and devoted; but his quota of pupils is the same whether he exerts himself to the uttermost or not.

In conclusion, it is both fair and important to call the reader's attention anew to the fact that the differences between American medical schools are far greater than the differences between their time-cards. It is bad enough that all alike run a graded four-year course which almost everywhere places upon all students a burden that is excessive and unwise; that schools graduate together those who begin together; that all reckon in

[7] A qualification should be added: the continental professor is also the state (as well as the university) examiner. Students are to some extent influenced to take the professor's courses by this consideration. On the other hand, younger instructors, enjoying no such advantages, are spurred in their efforts to obtain students, because of the handicap—not a bad thing for them. The English system, under which examiners are sent from one institution to another, is excellent.

hours and courses rather than in terms of large, massive subject-accomplishments. With all this, however, the difference is great between schools in which electives exist and schools in which there are no electives; and still greater, when the voluntary element has been introduced. To some extent, also, diversity arises from the use to which the long summer vacations are put. The curriculum—even the rigid curriculum—is, in fact, far from being the most important element in determining the character of the school. The qualifications and preoccupations of the faculty are infinitely more significant; and in these respects there has been, as we shall see in subsequent chapters, notably in the laboratory subjects and in some places on the clinical side, marked improvement in America within the past ten or fifteen years. Thus the distance that separates productive university schools of medicine from humdrum teaching centers must not be obscured by the superficial—even though harmful and deplorable—resemblances in the structure of their respective time-cards.

IV

The Canadian curriculum is in process of transition, in consequence partly of an effort to elevate the standard of preliminary education, partly of the necessity of carrying the final stages of secondary education into the professional school. At the present time the student may spend from five to seven years in the medical school—but part of the first three years is devoted to quite general subjects (modern languages or history) and part to the basic sciences; one year may be subtracted if the student, on graduation, is willing to accept an inferior degree, or to forego an academic degree.

The variation in length of time does not therefore represent elasticity in the continental sense; for the Canadian curriculum, like that of the United States, is a graded course, each year a unit, and so administered that a "conditioned" student may not advance with his class. He is therefore annually held

accountable for certain "courses," as against the preferable continental way of holding him accountable, after the lapse of a variable number of years, for the mastery of a subject, however such mastery may have been acquired. Other marks of the old-fashioned schoolmaster are also present, for attendance is recorded and certified by instructors and lecturers to the dean. Thus the lock-step type of curriculum and class organization prevails. Finally, the average yearly requirement in respect to the number of hours of instruction generally accords with practice to the south of the border: Toronto, for example, sets up a total requirement of 5,945 hours for six years; McGill is slightly more moderate, requiring 3,520 during the first four years, the fifth year, which is a practical hospital year, not having been made a matter of definite hours.

Toronto alone has, though within the class framework, developed a system of "optionals." During the first three of the six years, the Toronto students carry their fixed regular program year by year and day by day; every year there are open spaces in the time-table, which, however, they are compelled to fill up; in the first medical year, one option must be exercised among cultural subjects; in the second and third, one cultural and one scientific subject must be chosen, a dubious and probably ineffective device.[8] During the last three years, students who "have attained a certain standing in the courses of the first three years" are permitted to follow options annually in any of a large number of fields of study. Those who have not made good records previously are obligated to take a "review" or "repeat course." Though the final choice is largely left to the student, he is warned against aimlessness, and a faculty member is designated to assist him in reaching an intelligent decision. The authorities are obviously eager to stimulate the capable to do more work, and more fundamental work, but they are evidently of the opinion that the Canadian student is far from ready for academic freedom even in the domain covered by the optional courses; and he is still forced to do stipulated

[8] A student who has an Arts degree is exempt from cultural options.

amounts annually, rather than held accountable for larger achievements, performed more or less in his own way, at the close of longer and varying periods.

V

In respect to general arrangement, the French adhere to the "natural" method of teaching medicine; all other nations have adopted the logical or progressive scheme, such differences as exist between Germany, Scandinavia, Great Britain, and America being of minor importance. In so far as mere arrangement goes, the French are in this matter probably wrong, the others probably right. Whether a complete block should be established between the laboratory and clinical sections as in Great Britain is perhaps not of prime importance; but that the student avoids sheer and unprofitable confusion and attaches clearer conceptions to terminology, if pictures of normal structure and function are developed as a preliminary to his study of disease, seems to be approved by educational theory and to be established by experience.

On the other hand, though I should be disposed to hold that the large distinction between the "natural" and the "logical" curriculum is important, I cannot but feel that it is also important not to attach too much importance to the niceties of curricular mechanism. In America, particularly, much attention—and in my opinion, far too much attention—is given to the elaboration of devices known as correlation and dovetailing, and to the working up of special exercises designed to present rounded or neatly completed entities to the student, so that he may see things in relation, or to the simultaneous presentation of different aspects, so that he may be spared some of the toil of learning and some of the danger of forgetting. Broad differences affecting general arrangement are worth considering; but fine distinctions, little niceties, ingenious devices, paring a few hours here for distribution elsewhere—these time-

and soul-consuming dialectics are worse than futile. By no deftness of device can the human spirit be trapped and trained. It is doubtless true that the inferior student may learn and perhaps remember some things, if they are thus worked up for him, that he will not learn otherwise. But whether, in the long run, even he is thus converted into a different kind of person may be doubted. It is more likely that, free at graduation from the control of teachers who have done his thinking for him, he will relapse into the practical routine which is congenial to him. Meanwhile, two other groups, both more important, have been injured: the teachers, who have spent themselves too lavishly and conscientiously, and the abler students, who are weakened by being over-taught. Thus even if the ordinary student is temporarily forced up to a somewhat higher level, an excessive price is paid by the teacher and the abler student.

The fact is that medical education is bound to be fragmentary. There is something deceptive in the appearance of completeness. The rough edges are really significant, because they suggest the need of further study, reading, and reflection in many directions. Good teaching is, of course, priceless; but good teachers accomplish most, not by painfully consuming their time and energy in over-elaboration that does everything for the student, but rather by the vigor, originality, and freshness with which the day's theme is expounded without being exhausted. The notion that the student can be kept from forgetting his anatomy, physiology, or pathology if only the proper curricular arrangements can be hit on is doomed to disappointment. It is true that associated facts, principles, and phenomena are more significant than disconnected data. It is also true that teachers may give the student a few illustrations of material, well worked up from different points of view. But this does not mean that it is either feasible or desirable to construct a curriculum on such a basis. Of course, the student will forget. Of course, there are things that he will not know just when he most needs them. This should go on happening to him

all his life. In the medical school, he will himself have to review what he once knew, and to extend what he once learned; his teachers will remind him, will review, will urge him to read further—just as they ought, all their lives, to be doing themselves. No curricular arrangement can or should aim to prevent such effort. It is indeed no paradox to assert that, though medicine can be learned, it cannot be taught. The student must throw himself eagerly and intelligently into the quest. He must want to learn. He may not depend upon the exposition, demonstration, or coöperation of his teachers. There is, as I have said, a certain general logical order in which various subjects may well be presented; successive teachers can utilize each other's subjects as they proceed; occasionally a group may work out in detail a problem in correlation. But at best such demonstrations will be only illustrative. "Every educated man is self-educated." There is no substitute for the learner's initiative.

VI

Medical curricula the world over contain too many subjects as well as too much material. The burden would be heavy enough, if it were confined to the larger, original units; but within the last fifty years one specialty after another has been split off, erected into a professorship, made a subject of special teaching, and finally won a place on the examination list. From the standpoint of inquiry and treatment the argument for specialization is, on the whole, unanswerable; but real problems arise in connection with teaching. Yet the principle underlying an adjustment that is as satisfactory as the adjustment of any insoluble problem can be has already been stated. Men become educated by steeping themselves thoroughly in a few subjects, not by nibbling at many. The medical curriculum cannot aim to produce physicians ready for practice; it can at best so train students that practical experience, in the first instance as interns, will in time mature and equip them. The undergraduate course is obviously not the place for the finished

training of otologists, laryngologists or dermatologists; it can include only the simplest instances of special technique, and that mainly because they figure in ordinary diagnosis. For the rest, the specialties should be deliberately postponed until the necessary elements can be acquired in connection with a hospital experience preceding independent practice.[9] But curriculum makers and state authorities have thus far been unable in any country to adhere to the principle above stated; the curriculum in consequence looks as if it were meant to train physicians, though no one any longer supposes that it can.

In this matter the German curriculum, on its face, sins more grievously than the American. But, in operation, the American scheme is the more harmful. The abler the American student, the more conscientiously he complies with the letter of the law, the less time he has to read and work at will. The German student, like the continental student generally, pays for required courses and must be signed up for them, but attends or not, according as he finds it worth his while or not; the abler he is, the greater freedom he takes to himself. In a few practical courses, his attendance is more or less loosely controlled. But in the main the university practically leaves him free to work out his own salvation and in his own time. Neither annually nor semi-annually must he prove that he has performed an allotted task. He may overwork one term and underwork another; he may master a subject by following regular channels, irregular channels, or both. Thus the mediocre and the brilliant diverge greatly, as they ought. In this way the apparently overburdened continental curriculum simplifies itself as far as regular routine is concerned—partly through varying the time devoted to studies, partly through distributing attention and effort differently. The university and the state pass judgment through examinations for which the student presents himself

[9] Billroth, loc. cit., pp. 216 ff., gives an interesting historical sketch of the founding of the successive chairs. Waldeyer discusses the educational problem above touched on, loc. cit., pp. 189-195. He makes the point by means of the proverb: *"Non multa, sed multum."*

when, in his own judgment, he is ready. At these periods, the student is indeed driven, or, rather, he drives himself.

Poor teaching on the continent is, as we shall find, common enough; but defects due to ill-judged methods of teaching must not be ascribed to curriculum arrangement. They are, as we shall learn, due rather to adherence to traditional forms of instruction and to lack of adequate facilities for practical work. If we assume facilities adequate to the number of students, and students no more numerous than the teaching staff can reach, the informality of the continental university is beyond question more stimulating to the student of medicine than the uniformity of the American curriculum.

Aside from factors already specified, viz., poor secondary education and the desire to embarrass poor medical schools, the differences which I have emphasized also involve different theories of education, medical and general. The continentals know that it is futile and impossible either to be encyclopedic, or to agree on sets of facts which all alike should know. They have learned that good students, as they go through their training, will learn the important facts and principles, not because these facts and principles have been segregated for teaching purposes and drilled into them, but because they continually recur. Moreover, practical experience will rapidly extend the knowledge and improve the judgment of those who possess the right attitude and basis. "The physician becomes a physician only when he is a physician"—in these words, already quoted, the continental philosophy of medical education has been expressed. In its crudest form, the notion in the minds of the American curriculum makers is, by contrast, expressed in the following description, taken from the catalogue of an eastern university: "A *thorough* and *comprehensive* curriculum—one sufficient to impart to the student a *complete scientific* as well as *practical* medical education has been arranged." [10]

[10] Curriculum makers would do well to ponder the French proverb: "*Qui trop embrasse mal étreint.*"

It does not follow, however, that it would be advisable for American medical schools to adopt at once the continental procedure. There are at least two obstacles. In the first place the American faculty is as yet far from being a professionalized group of teachers on the clinical side; and until the clinical instructors are as a body primarily teachers, actively sympathetic with the laboratory workers and themselves primarily devoted to teaching and research, artificial means of holding students must continue to exist. In the second place, the students must be a trained and selected group, in Helmholtz's words, "with a sufficient habit of mental exertion . . . and able to discriminate truth from the mere appearance of truth." [11] Our secondary schools and colleges do not as yet reliably produce such a body. Nor, even when that time comes, should we be under any illusion. Academic freedom is not without its perils; undoubtedly many a frail bark goes to wreck on the shoals. On the balance, however, there is no question that the student's freedom has justified itself in Europe. It has given the ablest the fullest opportunity; it has in the end braced the mediocre; and it has forced the professor to exert himself, as his only way to secure reputation and followers.

While American conditions do not perhaps warrant the immediate and universal introduction of university freedom, there can be no question that the country is ready for marked advances on the part of institutions that are introducing professionalism into the faculty and are gradually obtaining a more carefully selected student body. Strong institutions should not be deterred either by state boards or by educational associations from proceeding further and rapidly in the direction of university methods.

[11] Helmholtz: *On Academic Freedom in German Universities.* (Inaugural Address as Rector of the University of Berlin, October 15, 1877.)

CHAPTER VII

THE LABORATORY SCIENCES

A—CONCEPTION

I

The laboratory sciences are so often thought of in instrumental relation to medicine that it may perhaps not be amiss to restate at this point their proper status. Anatomy, physiology, and pathology are sciences as such, just as they would be if it had never occurred to any one to include them in a medical curriculum; just as physics and chemistry are sciences, as they would be, if there were no such things as physiology or industry. These sciences, all alike, belong in the university, because, in the first place, they are objects of human curiosity, and because, of course, in the second, their prosecution yields in a thousand ways practical benefits to human kind. The history of science has shown incontestably, that, in the long run, the untrammeled study of science brings not only the fullest intellectual satisfaction, but, also, strangely enough, the largest practical return. The so-called medical sciences form no exception to the rule; once in the university no arbitrary limit can be set to their development.

Unquestionably their designation as medical and their usual, though not invariable, location in the faculty of medicine rather than the faculty of science, have, as a matter of fact, tended to narrow their scope. As far as the qualifying adjective, "medical," is concerned, it would be as unfortunate to limit research in physiology by reference to human medicine, as to limit research in physics by reference to human industry. Inclusion in the faculty of medicine signifies merely that certain aspects

of the general subjects—and these by no means so narrow or so uniform as is sometimes supposed—are pursued by a particular group engaged in professional studies. For these purposes the professor of physiology is, for the time being, one of several persons (anatomist, pathologist, and clinician) interested in a definite training problem; and from these associations—investigative and practical—he may himself derive stimulus.[1] But, meanwhile, his relations to his associates in the medical faculty need not necessarily be any more intimate, and may be less fructifying, than his relations to the mathematician ~~or~~ the physicist, who, for convenience' sake, are organized in some other faculty. It is precisely the advantage of the university status that while, to accomplish a professional purpose, a professor is a member of a professional faculty, none the less, as scientist, he is a member of the university with freedom and incentive to pursue truth in any direction whatsoever. Limitations will establish themselves, but they need only be the limitations of capacity, inclination, facilities, and resources. The fields are too vast and too overlapping to permit of orthodox organization and delimitation. Hence no two departments in any given subject will duplicate one another. And this, indeed, is fortunate, for diversity of attack increases the chance of apprehending truth.

If the conception I have sketched is clearly held, details of arrangement have no fundamental significance. Anatomy was as broadly cultivated by Mall *within* the medical faculty as was physiology by Foster and Langley *without,* and meanwhile in neither case was breadth of conception in research inconsistent with sensible recognition of the needs of professional instruction. The increasingly obvious interlacing of the clinical sciences and the pre-clinical sciences, from which only

[1] Let it not be forgotten that a chemist (Pasteur), influenced by methods used in physics while endeavoring to solve practical problems, created the science of bacteriology, itself, obviously, a broad science, reaching far beyond the domains of medicine and public health. (Vallery-Radot, loc. cit., pp. 76-77.)

tradition and convenience could nowadays exclude physics and chemistry, sometimes occasions uneasiness, on the side of physicians for fear that the medical student may be overlooked, and on the side of the investigator for fear that the sciences may be too narrowly conceived. Neither fear is groundless; either result might happen. Only good judgment on the part of individuals, or, better still, a variously constituted group in which the eccentricity of one is compensated by the idiosyncrasy of another, will preserve the unsteady equilibrium of a living organism.[2] But meanwhile, we may comfort ourselves by the reflection that in any case the student's knowledge at the end of his university course will be fragmentary and far from uniform, and that stimulus will in the long run avail him more than acquisition. Further, as we shall see, clinicians are being trained who view clinical medicine itself as a science. Assuredly contact under such circumstances in the heart of a university will enrich, rather than limit, every participant in the search for fact and law.

The foregoing considerations have their bearing on the choice and training of laboratory teachers. If the so-called pre-medical sciences are to be prosecuted primarily as sciences and not as handmaids to medicine, it is relatively immaterial whether a particular teacher be a graduate in science or a graduate in medicine. Variety being stimulating, there is in fact a distinct gain in mingling men with clinical and men with non-clinical background. Indeed, as the clinics expand on the laboratory side, they are not unlikely to attract men particularly interested in the clinical application of the underlying sciences. Anatomy is to some extent likely to be recruited from biology; biochemistry, physiology, and bacteriology from the corresponding or other departments in the university faculty of science; chemistry, physiology, and pharmacology from one another. The unimpeded flow of workers from one university laboratory into

[2] Fortunately, extreme cases—men who cannot effectively participate in teaching or profit by it—may be segregated in research institutes. See Chapter XII.

another may offset a shortage on the medical side, and tends to preserve breadth of spirit in both teaching and research. The vitality and breadth of anatomy, biochemistry, and bacteriology in the United States may be in part due to the absence of any line of cleavage, for they have drawn many recruits from non-medical laboratories, as has physiology at Cambridge. Contiguity to the rest of the university is of more importance than the particular way in which the medical faculty is framed. The medical staff may even be merged into the faculty of science—a step that has been taken at Chicago—the medical faculty being preserved merely as a convenient administrative unit for professional instruction. With a hospital located on the university campus, conducted by men primarily interested in disease, there is little danger that the balance, which is important for the undergraduate student, will not on the whole be preserved,[3] and much worse things may happen to the student and future practitioner than the tilting of the balance, here and there, to the scientific side.

II

Our interest in the present account of medical education is twofold: we are inquiring as to present conditions in various countries, but we are also interested in the trend of development—to some extent also in the rate of progress. For the purpose of exhibiting the various medical sciences from these points of view, I propose, first, to characterize each of them briefly from the standpoint of conception and facilities in various countries,

[3] The rôle of the Ph. D. apart from the M. D. in developing medicine is discussed by Professor Charles R. Stockard in a paper entitled, *The Laboratory Professor and the Medical Sciences in the United States.* (Journal of the American Medical Association, Vol. 74, pp. 229-235.) I do not myself believe that the development of laboratories within the clinics is a real menace to the pre-clinical sciences; I rather incline to think that in the long run it will stimulate and enrich the underlying sciences. Any way, the two appeal to different types of mind and interest. In general, the more numerous the opportunities and the more varied the incentives, the larger will be the response.

say, approximately, fifteen years ago, and subsequently, from the same two standpoints, to characterize them in rapid succession as they stand today. The period is, obviously, a very brief one; yet, as we shall see, thought and effort have been so active that distinct progress can be made out.

Anatomy

Fifteen years ago, in Germany, and those countries of northern and western Europe, which in respect to university development stood with her, anatomy was generally viewed from both structural and genetic viewpoints; it was conducted by a staff, one or another member of which spoke for morphology, histology, and embryology. In France, at the same date, anatomy concerned itself practically altogether with dissection; histology was generally cultivated as microscopic anatomy—a separate branch, detached from both anatomy and physiology, to its own detriment and the detriment of both the other subjects. A similarly uninspiring and static conception prevailed in Great Britain, where, for the most part, anatomy began and ended with the dissection of the adult cadaver. In America, conditions were chaotic: in a dozen universities, some of them situated in outlying places, the broad and fruitful German view had been introduced; in many other schools, the English order obtained, surgeons, active or on the way to activity, conducting a more or less malodorous dissecting room; in the outright commercial enterprises, textbook, quiz-compend, and an occasional chart took the place of all but an occasional, sometimes a rare, cadaver.

Physiology

Physiology, viewed as the experimental study of function, had reached a substantially equal status in Great Britain, Germany, and Scandinavia; human physiology, as cultivated by the medical student, was not severed from general physiology; the physiologist pursued a broad and independent science in the ways that promised the most fruitful results. The various

approaches to the subject were represented by the chemical, physical, and operative divisions of the physiological institute or laboratory. The same conception had been brilliantly enunciated and illustrated by Claude Bernard in Paris; but he had had little influence on the French medical school, which, in the main, concerned itself with graphic method and a description of function, such as was deemed likely to serve the particular needs of the prospective doctor. The American situation could, once more, be described in the terms employed in reference to anatomy. A few schools embodied the broadest European conceptions, brought to America in the first instance by Bowditch, a pupil of Ludwig, and later by Newell Martin, a pupil of Foster; the rest found all that they required within the covers of a textbook on human physiology, written with an eye to the supposed needs of the practitioner.

Biochemistry

Biochemistry developed in Sweden and Germany as a natural outcome of their superior development in the field of organic chemistry, which in Liebig's hands included both branches of the subject. There, earlier than elsewhere, physician and physiologist appealed to the chemist. Chairs in biochemistry created sometimes in the medical faculty, sometimes in the faculty of science, were filled by Hoppe-Seyler, Hammerstein, Salkowski, Kossel, and Fischer, who influenced profoundly the general development of biochemistry as well as its application to medicine. A single chair—that of Chittenden, a pupil of Kühne, long the only center of biochemical activity in America, had been established at Yale in the Sheffield Scientific School as early as 1882. In England the subject was generally neglected, though Hopkins had already begun his fruitful career at Cambridge.

Pharmacology

Though naïve faith in a huge pharmacopœia had been pretty well undermined, the experimental study of the action of drugs

was fifteen years ago limited to the German universities, a few progressive American schools, and to one or two English institutions. It was far more active and widespread in Germany than in any other country. At the outset the sphere of pharmacology was critical rather than constructive—covering, that is, mainly—though even then not exclusively—the experimental study of drugs in common use rather than the discovery and invention of new agents. Elsewhere in Great Britain, in France, and in most American schools, the old materia medica held sway; and the tedious description of the appearance, source, and supposed virtues of an infinite number of drugs, roots, and herbs occupied a chair tenanted by a practitioner of long experience.

Pathology

The founder of modern or cellular pathology, Virchow, was alive to both sides of the science; he realized that it must embody both the anatomy and the physiology of the abnormal organ. The ablest of his disciples, Cohnheim, stressed strongly the physiological and experimental aspects of the science. As a matter of fact, however, the anatomical side was mainly cultivated in Germany, as in Holland and Sweden, in contrast, curiously enough, with Austria and Denmark, where experimental pathology had already thirty years ago reached the dignity of a special chair.[4] Two institutes, equally handsome and attractive, represented at Copenhagen respectively the anatomical and the physiological aspects of the subject. Meanwhile, the German institute of pathology was, in the main, an institute of morbid anatomy, corresponding in its morphological, histological, and etiological interests to the general scheme already observed in anatomy. Among other reasons, the heavy routine connected with simultaneous service to medical school and hospital tended to restrict development on the experimental side. Pathological institutes of this description were found not

[4] There is now in Germany one Institute of Experimental Pathology, viz., at Cologne.

only in university hospitals but in all the larger state and municipal hospitals; and the professor of pathology was always, in virtue of his university post, pathologist to the university hospital. Experimental pathology was cultivated in Germany, but mainly in the laboratories of physiology, biochemistry, hygiene, and pharmacology, and in the laboratories of the medical and surgical clinics; and such is still in general the situation.

In Great Britain and France, despite their promising start in the eighteenth century and in the early decades of the nineteenth, pathology was fifteen years ago deadhouse anatomy, a tool of the clinic. Except at Glasgow, nothing resembling an institute of pathology, where even morbid anatomy could be freely pursued for its sake, could be found in either country. Autopsies, to be sure, were abundant; but they were made, as a rule, by junior members of the medical or surgical staff, intent largely upon verifying or upsetting a diagnosis. The situation in the two countries, in so far as medical education was concerned, differed, however, in one important respect: in the English medical school growing out of the hospital, the hospital deadhouse was at least an organic part of the structure. In France, as I have repeatedly stated, the medical faculty of the university was one thing, the hospital was another. There is no institute of pathology linking school and clinics. Hence, the university chairs of pathology in France—anatomical, experimental, and comparative—are connected only with the autopsy room of the hospital service belonging to the professor of pathology in his capacity of hospital physician or surgeon; the chair of pathology as such possesses no autopsy facilities, except at Strasbourg, where the Germans had provided an institute of pathology common to the entire university hospital.

Fortunately for us, the modern experimental conception of the subject and of the essential combination in one person of the full-time professor of pathology and the hospital pathologist had been introduced into America by one of Cohnheim's pupils, Dr. William H. Welch, who had chanced, moreover, to work in Cohnheim's laboratory side by side with Ehrlich,

Weigert, Salomonsen, and Neisser. The experimental conception of pathology, embodied in one of the wisest and most winning figures in medical history, thus fertilized the sterile deadhouse pathology. The experimental tendency was further assisted by a defect not yet cured, viz., the difficulty of obtaining autopsies, as a result of which experimentation was almost inevitably emphasized. American pathology became thus an experimental science. Meanwhile, in point of number, fifteen years ago, most good American schools were still teaching morbid anatomy under only fairly satisfactory conditions; not a few either ignored the subject or taught it from a textbook with the doubtful aid of a few discolored specimens.

Bacteriology

The modern science of bacteriology, French in origin, had developed outside the medical faculty in special institutes named for the founder of the science. The reason was twofold: Pasteur was not a member of the medical faculty; the conventional teaching duties of the faculty would not have harmonized with either the broad practical or the equally broad investigative program which his far-seeing vision contemplated. The Pasteur Institute at Paris, and subsequently similar institutes at Lille and Lyons, relieved the medical faculties of the teaching of the subject, except in so far as clinical bacteriological courses were given in the hospitals. The evolution of bacteriology in France suggests some curious reflections. Its splendid development has brought unique distinction to France; and this development was due, not only to the fact that Pasteur was a genius, but to the further fact that he encouraged pupils of diverse interests and abilities to work in every possible direction. The subject was of prime importance to medicine and hygiene; but it was not restricted to them. It might have occurred to some one that other sciences touching medicine would fare equally well, if equally favored. But such was not the case. The medical sciences within the medical school remained largely

what they had been. It almost seems as if Pasteur's brilliancy, his combativeness, his dramatic achievements, and his practical discoveries focussed French attention on a subject, rather than on a method or conception, equally applicable to the other sciences connected with medical study.

In Germany, the universities had long been in possession of institutes of hygiene, devoted to the empirical, as well as experimental, study of ventilation, soil, and water supply at the time of the rise of bacteriology. Largely through the achievements of Koch the new science was at once appropriated by hygiene and rapidly developed outside as well as inside the university by means of institutes and laboratories engaged in bacteriological research, in teaching students, in training health officials, and in carrying on sanitary activities.

In Great Britain, bacteriology was variously disposed of. At London, the Lister Institute was, though with slender resources, following the example of the Pasteur Institute; it remained a thing apart, because, in so far as research was one of its objects, it was well understood that the subject had at that time nothing to gain from the clinically minded medical schools of the metropolis. Meanwhile, the medical schools themselves attached the subject now to pathology, now to the clinical laboratory, and at one or two places gave it almost independent status. In America, a few independent university chairs existed; otherwise, bacteriology formed a division of the few university chairs of pathology. Instruction in hygiene, as part of the medical curriculum, carried on in routine fashion in Great Britain, existed as a separate subject in only a few American institutions fifteen years ago.

Roughly summarizing the situation, one may say that in the universities of Germany, Austria, Scandinavia, and Switzerland the medical sciences were mature integers—taught and cultivated in the same spirit as were physics and chemistry; that in England physiology, and in France bacteriology, had reached the same status; that in America a few schools had attained the continental level. With these exceptions, the medi-

cal sciences were narrowly conceived from the standpoint of the needs of the contemporary physician and surgeon.

III

B—EQUIPMENT

The equipment of the several medical sciences in the schools of various countries corresponded closely with the conception entertained of the scope of the subjects and of the responsibility of the university beyond the mere teaching of students. Wherever large views were held and research was regarded as important, buildings and equipment, adequate to the type of instruction in vogue and to the special needs of the staff, were provided; or at any rate the ingenuity of the staff was more or less successful in devising workable makeshifts, for scientific interest is not easily defeated by the lack of material resources. Thus the relatively well-to-do German, Austrian, Danish, and American institutes were fifteen years ago more or less elaborately fitted out for research and possessed the apparatus required for the better type of undergraduate teaching. Particularly in Germany, scientific equipment of the highest order was by no means limited to university institutes. Municipal hospitals, health stations, and, as we shall see, research institutes, or institutes combining research with some practical function, were admirably equipped for scientific work, and being frequently headed by men who possessed a university title—that of docent or extraordinary professor—coöperated in teaching, especially in giving practical courses to both graduate and undergraduate students. Similar coöperation, especially in the field of pathology, between university institutes and hospital laboratories, was already then effectively taking place in Sweden and in a few places in the United States—Boston and Philadelphia, for example.

In smaller countries—Holland, Switzerland, Belgium, and

Sweden—the material equipment was uneven. At Brussels, for example, huge but ill-adapted laboratories, quite remote from the scene of clinical teaching, existed for some of the medical sciences. In Switzerland, at Bern, for instance, and in some of the Dutch universities, the plant was compact and unified and some of the laboratories excellent. At Utrecht, the institute of pathology was a striking building, admirably designed and equipped. In the smaller countries in question the difficulties of procuring expensive apparatus, abundant supplies, and larger staffs were by no means slight, but it is a striking and inspiring fact that work was not halted and sometimes seemed even not to suffer. Absence of apparatus may have been a positive stimulus to creative thinking. One could not visit Einthoven's laboratory at Leiden, Johansson's at Stockholm, Kronecker's at Bern, or Magnus's at Utrecht without being struck by the fact that limited resources carefully used from year to year in time build up a good equipment, and meanwhile provoke rather than defeat scientific determination. In Great Britain, a few laboratories were well equipped for both teaching and research, even though the outward appearance was by no means imposing. The physiological laboratories at Cambridge, Edinburgh, and two or three of the London schools and the group of laboratories at Glasgow were physically adequate for both teaching and research; the same could be said of anatomy at Manchester. Elsewhere and in other subjects the equipment was, generally speaking, on the merely instrumental level. Anatomy had its dissecting room and museum; pathology possessed a deadhouse in a hospital, with a museum and classrooms in the medical school across the street. There were poor facilities for chemical investigation or animal experimentation, because the subject was in general conceived as a clinical tool. Bacteriology, like pathology, was an adjunct to medicine or public health, sometimes housed in the clinical laboratory of the hospital, sometimes tucked away in a corner of the medical school. Biochemistry, just developing, had almost no facilities or equipment.

In France, the defective material conditions almost universally prevailing in the laboratory branches—the laboratories at Nancy were distinctly better than the common average—were due to lack of money, to be sure, but even more to the subordinate position to which, excepting only bacteriology, the medical sciences were held. At Paris, the faculty of medicine possessed an externally imposing group of buildings, but anatomy occupied but a series of crude dissecting pavilions and almost bare lecture rooms, while physiology was pathetically meager, and pathology better merely to the extent of its museum and microscopes. The lack of facilities corresponded with lack of emphasis and interest.

America represented an enormous diversity. At Baltimore and Ann Arbor a complete and for the time satisfactory series of laboratories, simple and unimposing in structure, had been provided. At Harvard, the palatial laboratories of the medical school had already been constructed. The new medical laboratories of the University of Pennsylvania, opened in 1904, housed in excellent fashion pathology, bacteriology, and pharmacology. Here and there, amid unpromising surroundings and with meager facilities, young men, who have since then developed to full stature, were working in the modern spirit. For the most part, however, support was scanty and equipment lacking. Of the huge number of medical schools then existing in America—over one hundred and fifty in the United States and Canada—an overwhelming proportion were bad and badly equipped beyond anything that could be found anywhere on the continent.

IV

C—PRESENT CONCEPTION

In point of theory, all the medical sciences have in the intervening period undergone more or less modification, following, in the main, developments in chemistry and physics.

Anatomy

In anatomy, partly in consequence of a change in the viewpoint of physiology, the study of function tends to attach itself to the study of form. Thus opens a new vista before the teacher as well as the investigator. He long since ceased to content himself with knowing merely the morphology of the human body; he is now not even satisfied when he has discovered the successive steps by which it has come to be; he wants to know how form and function are related; he wishes his students to think biologically. He ventures, indeed, in rare instances, even farther, and in coöperation with the scientific clinician carries on investigations in the anatomical and physiological aspects of abnormal conditions in the fields of surgery, obstetrics, pediatrics, and gynecology, which neither anatomist nor clinician could pursue alone. It cannot be said, however, that the functional conception of anatomy has as yet in Europe generally modified the architectural treatment of the subject—less so, on the whole, than in America. One encounters it, among other places, at Würzburg, Manchester, Baltimore, Berkeley (California), and at Cornell in New York City. At Berlin the anatomical-biological institute shows a tendency to absorb the practical work in embryology, histology, and comparative anatomy, which would reduce anatomy to dissection, anthropology, and comparative studies. In other countries efforts are still being made to reach generally the level attained in Germany ten years ago. In England notable progress has been made at Cambridge, and, above all, at University College, London; Cambridge has but just broken with the sterile Edinburgh tradition, is simplifying its museum, introducing embryology and moving towards the absorption of histology. At Manchester, an outright attempt is made to correlate anatomical and clinical studies; patients are brought to the laboratory; hospital record and X-ray plates are presented. The members of the departments of anatomy and physiology coöperate in teaching and research. Finally, the head of the department

holds two appointments as consulting neurologist—a dubious precedent not likely to be generally followed, if for no better reason than that more fruitful possibilities in other directions absorb the anatomist's time and energy. Elsewhere in Great Britain the existence of vacancies at least indicates growing consciousness that a young surgeon is no longer the proper person to fill the chair of anatomy. In America, the number of institutions in which anatomy has reached a fairly satisfactory status is now very considerable, though a complete anatomical institute, in the pre-war German sense, does not even yet exist in any American university. In France, the general situation remains unchanged; anatomy is still synonymous with dissection and textbook cramming. Even at Strasbourg it has been impoverished by the detachment of histology and embryology, the independence of histology being signalized by converting into a wall the doorway through which the departments of histology and gross anatomy formerly communicated. At times, as at Lyons and Strasbourg, the histologist, while teaching the subject in the more or less literal fashion that is alone feasible, breaks his shackles and embarks on an experimental enterprise in the physiological field. Thus Regaud and his pupil, Policard, at Lyons, and Bouin at Strasbourg, make of histology an experimental study of the cell; but, assuredly, as a matter of organization, detachment from physiology and anatomy is for this purpose unnecessary and unsound. At Stockholm also, histology and embryology are independent of anatomy; there the histologist has prepared thousands of slides which he and his students study and draw with infinite patience. At Brussels, embryology goes with anatomy, but histology, following French precedent, forms an independent chair; on its descriptive side it is admittedly less productive than formerly; but functionally viewed it is held—contrary to prevailing opinion in other countries—that an independent career is still possible.

Physiology

An even more definite shifting of emphasis has taken place in physiology. The classical physiologist approached his subject broadly from three sides: on the biological side, he was interested in correlations within the body; on the physical side, he was interested in the senses, muscles, and circulation; on the chemical, in metabolism. It is still true that most physiologists continue to concern themselves with further study from these angles and their application to the comprehension of clinical conditions. In the atmosphere of the medical school physiology has rather tended to keep within these limits, though there have been vigorous exceptions. Thus, heart, brain, and kidney, normal and abnormal, have been functionally studied by the increasingly effective methods—biological, physical, and chemical—devised in the physiological laboratory. Meanwhile, a small group of younger men, in Germany, England, and the United States, stimulated by the researches of Pasteur, Jacques Loeb, Höber, and the Cambridge school, are endeavoring to apply the methods of physical chemistry to the study of cell-life—a line of investigation prophesied by Ludwig over sixty years ago.[5] At first sight the interest seems remote from the clinic; but it may well turn out that a deeper understanding of the problems of disease will follow upon developments of the new physiology, precisely as, in the generation past, proved to be the case with the physiology of Helmholtz, Claude Bernard, Ludwig, and Foster, which at the time seemed to the clinician of little or no practical import in the comprehension or treatment of disease.

Meanwhile biochemistry has continued its development—now in close contact with organic chemistry, now in coöperation with physiology or medicine, again, as an independent science attacking the problems of tissue structure.[6] In America,

[5] *Lehrbuch der Physiologie der Menschen* (edit. 1858), p. 50. For this reference I am indebted to Professor Asher of Bern.

[6] Copenhagen is one of several places which still lack a chair of biochemistry. The subject is there taught to medical students by an

within this period, separate chairs have been created in practically all the important schools of medicine, and various types of approach and interest are represented by Folin, Henderson, Levene, Van Slyke, and the pupils of Chittenden.

Pharmacology

Pharmacology continues its chemical interest; but the subject is on the threshold of a corresponding development on the physical side. In an extraordinary fashion, chemist, biochemist, physicist, bacteriologist, and pharmacologist have combined to make an aggressive attack upon disease. The constructive activities of the pharmacologist have developed amazingly as one laboratory product after another has demonstrated its efficacy in combating discomfort or disease. Meanwhile theoretic interest has not waned, for the pharmacologist has not restricted himself to practical problems. On the surface his field overlaps physiology on the one hand and medicine on the other—as medicine, pathology, and physiology themselves likewise overlap. But neither physiologist nor internist can exhaust the creative possibilities of chemistry and physics applied to experimental therapeutics. Brilliant achievements have already been realized and new vistas have within a brief period been opened by the work of Ehrlich and his followers in the field of chemotherapy. While, therefore, pharmacology may now and then coincide with either physiological or clinical investigation, the pure pharmacologist will continue to develop his institute, untrammeled by either. And this, with not only intellectual, but often also practical results; for in no field has the irresponsible study of phenomena more frequently yielded the fact which eventually proved of direct practical importance. On the other hand, there are still schools—many in Great Britain and France and some in America—in which the old-fashioned teaching of materia medica has not yet been replaced by modern pharmacology.

assistant in physiology. Research workers in the clinics are thus without sufficient aid on this side.

Pathology and Bacteriology

Pathology and bacteriology have been tremendously stimulated by rapid and almost incredible refinement of methods and processes. Organisms, too small to be seen with the aid of the most powerful microscope fifteen years ago, have been either made visible or have been subjected to study by other means. The work of Pasteur and Behring in the field of immunology has thus been carried in a hundred different directions by pathologists, bacteriologists, and chemists until, in one disease after another, the causative agent has been studied or identified, the method of transmission unraveled, protection devised, and often a cure discovered.

In the medical school, at the very moment when research promises the largest returns, the clinician is apt to lean heavily on the pathologist and bacteriologist. In Great Britain, for example, where, in the main, pathology and bacteriology are still too often regarded as handmaids to medicine and surgery, inclusion in the medical school and contiguity to the hospital at times, in default of ideals, facilities, and support, prove a disadvantage; for energy that is needed for teaching and research is diverted to the doing of Wassermann tests and the preparation of vaccines and sera.

With the rapid scientific advance in bacteriology which I have above barely outlined, the outlook and spirit of the medical school have already been perceptibly modified; prevention —both socially and individually viewed—is coming to figure more largely in the student's training and in the practitioner's activities. Nor will the challenge of the humanitarian bearing be without its effect even upon the imagination of the investigator. Faculties of public health have, to be sure, also been established; but this does not mean that prevention becomes *their* business, while cure remains the concern of the physician. On the contrary, within the medical faculty itself it has become increasingly impracticable to study the diagnosis and cure of disease without consideration of its eradication and prevention.

V

D—PRESENT EQUIPMENT

Externally, there is abroad little to indicate the change in tendencies which I have just described. In France, the laboratory situation remains what it was in the way of facilities and equipment, except for the acquisition of Strasbourg. Defective as the laboratory facilities of the French have been and still are, their attitude is, from their point of view, not inconsistent, though it is, in my judgment, quite unsound. For their medical faculties, like the older English hospital schools, exist avowedly to train practising physicians and for this purpose—so the French argue—the hospital is of overshadowing importance, the laboratories play a distinctly subordinate and merely instrumental rôle. In other countries, the war checked a movement in building and equipment that would have accompanied and facilitated the developments which I have noted, just as unquestionably it delayed the evolution of the several sciences; and this, not only in the countries involved in war, but in neutral countries as well. Nevertheless, in places the new wine has been successfully decanted into old bottles. At Cambridge, for example, the new anatomist has ruthlessly cleared out the accumulations of a century, and old quarters with modest equipment are inspired by the modern conception of his subject; in the same institution, a highly active center of biochemistry, developed by F. Gowland Hopkins in three disconnected and ill-adapted buildings, is now, fortunately, housed in a modern laboratory; an attractive laboratory for teaching and research in parasitology has just been opened; and a modern laboratory of pathology is in near prospect. At Oxford, the recently established chair of biochemistry will shortly be adequately housed, equipped and supported.[7] But

[7] The Dunn estate of £500,000 was left for "the alleviation of human suffering." It is interesting to note that the courts held that medical research met the intention of the testator. Thereupon the trustees

the most notable improvement in equipment is under way at University College, London, where an anatomical institute, nowhere excelled, has been provided for anatomy, histology, and embryology. Two abandoned churches, ingeniously united and subdivided, form the busy laboratory in which Magnus has introduced experimental pharmacology into the universities of Holland; at Leiden, experimental pharmacology is active in improvised quarters. In Germany, accommodation and adaptation to new viewpoints have been easier; for institutes, adequate to begin with, can readily be adapted to meet a change in emphasis. But everywhere in Germany equipment has suffered horribly in consequence of the war. As I have previously pointed out, even in the years immediately preceding 1914, complaints were heard that, in consequence of the demands of army and navy, equipment was not keeping pace with the number of students or the needs of research. Following the peace, the plight of the German laboratories became tragic. The most elaborate and best supported scientific institutes in the world, taken as a whole, suddenly found themselves reduced, as by an earthquake, to abject poverty. New apparatus could not be bought; old apparatus, as it wore out, could not be replaced; current materials—glassware, animals, and chemicals, once abundant—became rare and precious. The funds available were inadequate to supply food for experimental dogs, cats, and guinea pigs; for a time they scarcely afforded an occasional frog. Most serious of all, foreign books and periodicals could no longer be purchased; and the printing and illustrating of native journals became more and more difficult. It is obvious that under these conditions teaching must become more and more didactic. Gross studies in anatomy and pathology could indeed continue under difficulties, due to lack of heat, gas, water, and service; but practical courses in physiology, chemistry, and bacteriology had necessarily to be curtailed. Relief,

allocated £210,000 for buildings and endowment for biochemistry at Cambridge, £100,000 for pathology at Oxford, and smaller sums for the laboratories of Guy's, St. Thomas', and St. Bartholomew's Hospitals (London).

inadequate but helpful, came from two sources: from the chemical and electrical industries which grant subventions to work likely to produce practical results; [8] and from philanthropic agencies which are supplying books and apparatus, as far as their resources allow. The loss incurred through these conditions does not affect German research and teaching alone; it represents a colossal net loss to civilization as a whole.

But it is naturally in America, where a generation ago there was practically nothing, that in the last decade most progress has been made on the material side. The great Harvard laboratories, of which I have spoken, were completed in 1906; since then new buildings have sprung up, and superior equipment, often costly and elaborate, has been provided in so many universities in both Canada and the United States that all cannot be enumerated and the citation of examples would be unfair; but at least I may note a few of the complete plants, admirably designed and equipped that have been provided in recent years —beginning with the total reconstruction (laboratory and clinical) at Washington University (St. Louis, 1914), and including the Sterling Laboratory at Yale (1923), the new medical laboratory at Western Reserve (Cleveland), and the remodeled and extended laboratories of the French University of

[8] In Berlin, for example, the *Vereinigten Fabriken für Laboratoriumsbedarf*, (V. F. L.) equipped a Biochemical Institute for Michaelis, a distinguished biochemist. As titular *professor-extraordinarius*, Michaelis had neither facilities nor budget—thus furnishing a striking example of the hardships to which the very wealth and energy of German science at times expose even the gifted worker. Such facilities and budget as Michaelis had were attached to another post which he also held—that of biochemist in a municipal hospital. Keeping his university title, he is now at the head of a splendid laboratory which also offers accommodations for a large number of research workers. The policy pursued by the corporation is most liberal: the laboratory, while serving industry, is free to go its own way, selecting for investigation theoretical as well as practical problems. For the moment there is a gain. Yet in the long run, the best-intentioned industries must fall short of being universities; so that such institutes as that of Professor Michaelis and other research laboratories maintained by industry, excellent as they may be, cannot be looked upon as in any wise adequate substitutes for university laboratories.

Montreal—the last-named an excellent illustration of the substantial results that can be accomplished with modest resources. On the other hand, despite these striking improvements, the situation as respects facilities is still in America highly uneven; and a large number of schools still struggle on, in one subject or another, with makeshifts that were out-of-date fifteen years ago.

In some respects, the conception realized in the most recent American plans represents an experimental innovation. The several institutes are respectively units, self-sufficient for the cultivation and teaching of the different sciences. But they are also at the same time parts of an organic whole, chemist, anatomist, physiologist, bacteriologist, and pathologist, working in their individual fields with all the stimulus and coöperation that proximity can give. Instead, therefore, of detached institutes of the German type, corresponding in form to the struggle for separate scientific integrity, America will shortly possess several more compact structures, in which the medical sciences of university scope, so firmly established—let us hope!—that they need no longer fear encroachment from one another or impositions from the side of the clinic—may be prosecuted and taught, independently or coöperatively, according to the demands of the specific undertaking. In Chicago, New Haven, Nashville, Rochester, and several of the state universities, these modern plants will be physically in equally close connection with the basic sciences in their respective universities. Thus the physiologist will be as close to the physicist as he is to the clinician. It will be interesting to see whether the possibilities of team work, thus created, in any wise tend to limit the scope or cramp the spirit of the participating scientists. Precisely the contrary is to be hoped; for informal groupings, dissolving when their purpose has been served, reforming easily and naturally as new purposes are matured, ought to be most effective in advancing both practical and theoretical inquiries. Dangers, avoidable only if good judgment is employed, beset both the independent and

the integrated type. The independent type of institute may lead to expensive duplication and lack of coöperation; the integrated type may tend to deprive the clinics of their special laboratories and to confine the medical sciences to a horizon defined by the clinics.

The speed and ease with which in favored spots a complete and brilliant material transformation has been effected in the United States is not perhaps wholly without danger. Kraepelin has suggested that, up to a certain point, equipment improves efficiency; beyond, increase of equipment may be at the expense of the higher efficiency. There are obviously some things that cannot be attempted at all without an expensive and elaborate outfit. Certain modern problems demand their appropriate technique, equipment, and conditions. On the other hand, the outfit is not invariably essential to the individual who thinks to use it; and, meanwhile, the stimulating effect of having to contrive is lost upon those who can too readily procure the latest appliance from the instrument maker.[9] Finally, there is ever the danger—so obvious in the effect of highly mechanized city life upon general education—that mechanism may tend to take over the work of the senses, and thus ultimately cripple them. A certain amount of difficulty in procuring additional tools is wholesome—particularly for young scientists. There is something in the argument—though it must not be pressed too far—that while facilities make for good work, they have had, as a matter of history, comparatively little influence on the fundamental contributions made by men working with meager resources under hard conditions. "I can work in a barn," said Ehrlich, referring to the dilapidated bakery and the old stable, in which he was housed at Steglitz; "I really need only test tubes, gas, and blotting paper." [10] A discarded hospital at Hampstead, equipped at a modest outlay, provides a com-

[9] A distinguished medical investigator, commiserated on the loss of his right hand, replied: "The loss has compelled me to work with my head." Not infrequently—though of course not invariably—the same remark would apply to the lack of apparatus.

[10] Marquardt, loc. cit., p. 63.

fortable home for the research institute set up by the Medical Research Council. Mediocrity, to be candid, is more dependent than genius. In any case, it is just as important, from this point of view, that young American investigators see the simple laboratories in which Hopkins and Einthoven have thriven, or Kronecker fitted out at Bern, buying one piece of apparatus annually, as the splendid research institutes of the Kaiser Wilhelm Gesellschaft at Dahlem.

I should perhaps entirely exempt from the foregoing caution one item—books and journals. The literature of medicine—historical masterpieces, the best current texts, periodicals and digests—should be readily accessible. In this respect, prior to the war, the German medical libraries, university libraries, and departmental libraries, and the corresponding libraries of the foremost American schools were highly favored. In England, the world's literature is accessible in Cambridge, Oxford, and a few central institutions in London; but the London schools and the provincial schools were and are irregularly supplied—a few persons or institutes being abreast of the times, the rest mainly, if not wholly, dependent on a few British journals. In France, the situation is on the whole even more unsatisfactory. The library of the Pasteur Institute was kept up to date; that of the faculty lacks means and is, moreover, remote from the hospitals. The hospitals usually themselves possess a few textbooks and receive a few French journals, though valuable collections of a special kind are to be found at Saint-Louis and the Salpêtrière. To help themselves, the association of the interns endeavor to maintain a library at Hôtel-Dieu, but its collection of periodicals is sadly defective. As a matter of fact, in the absence of research as a compelling motive, the faculties do not need complete files of the literature of medical science. Individuals who are active in the search for knowledge fend for themselves.

CHAPTER VIII

THE LABORATORY SCIENCES

TEACHING

I

Methods of teaching should be developed with a view to the objects aimed at, though they are inevitably affected by the conditions imposed by curriculum, facilities, and resources. We have seen that the medical school cannot expect to produce fully trained doctors; it can at most hope to equip students with a limited amount of knowledge, to train them in the method and spirit of scientific medicine, and to launch them with a momentum that will make them active learners—observers, readers, thinkers, and experimenters—for years to come. We have concluded, too, that the general arrangement of the curriculum, if sound, can make this task a bit easier, or if unsound, a bit harder; but in general much more—very much more—depends on teacher and student than on curricular mechanics or teaching devices.

In the chapter dealing with the character of modern medicine, we decided that medicine is to be regarded as an inductive science. Even empiricism, if intelligent, resembles science in that the practitioner observes carefully, though he may be unable to define limitations precisely or to ascertain causal relations.[1] Whether we know or do not know enough to pro-

[1] Crude empiricism ascertained the use of cinchona bark in malaria; less crude—or more thoughtful, i.e., scientific—observation brought about an increasingly intelligent use of quinine, still, however, not accurately delimited; finally, through Laveran's discovery of the malarial parasite, the causal relationship or connection was established. But inasmuch as quinine is not equally effective against all forms of the parasite, the circle is not yet complete. Chemotherapy is now being invoked. The whole thing is a question of more or less—not, of none or all.

ceed scientifically, medicine can at least be taught, practised, and extended in the cautious and inquiring spirit characteristic of scientific inquiry.

The methods to be employed flow naturally from the general position which I have endeavored to state. There is, in other words, a logical or sensible method of approaching the task, inherent in the subject matter and in the objects to be attained, and fairly independent of local conditions. Whatever variations may be due to traditions or national genius, assuredly medical science and medical practice are themselves sufficiently similar to suggest certain sound underlying principles of presentation, just as they suggest certain sound underlying principles of general arrangement.

To begin with, the practice of induction on the part of the physician implies active observation, reflection, and trial on the part of the student; for if the type of education in general determines the type of practice, then there is no reason to expect active observation and reflection from a student who has been trained in neither. Whether the student merely tries to learn what is already known (to others, be it noted, not to himself), or to practise what is known (whether by himself or others), or to find out what no one knows, he must proceed by observation, reflection, and trial. Now, undoubtedly, he cannot observe accurately if he is totally ignorant, since observation involves, as we have already ascertained, the recognition of an unknown element differing from something previously in the student's mind. The known from which he originally starts may be derived from his general experience, or from the science which he learned in school and college. From this basis, the teacher of anatomy and physiology sets out; thenceforward the student's powers of observation should be actively exercised in accumulating additional information of more and more sharply differentiated quality, and in forming habits which tend to make all subsequent experience both informational and constructive. What is true of anatomy and physiology at the beginning of his medical studies is progres-

sively true of other subjects. The active exercise of his faculties should store his mind with information, train him in a technique that makes all experience contribute to his growth, and, finally, equip him with the various practical skills that, as physician and investigator, he will in future employ.

The student must then be trained by doing things; if he is merely told, or if he merely reads, his training is inactive and hence remains on the informational basis. He will lack a vivid sense of slight but significant differences; he will be apt to fail to acquire the practical skill or the impulse to "try things" needed by both physician and investigator; and though he may be pedantically learned, he will probably have a rather vague sense of the meaning of his stores of information. Active participation—doing things—is therefore the fundamental note of medical teaching. Obviously, however, to no subject can the student devote the time requisite for complete mastery, practical or informational. Fortunately, the mind is so constituted that, after actual exercise up to a certain point, a quality closely akin to the quality of direct experience may be imparted to what is heard, read, or passively seen. Our capacity for learning would be meager indeed if we could learn only *by* doing. Men can also learn *after*, or even *while*, doing; that is, having actually carried through typical and representative tasks in a given field often enough and well enough, we can extend our knowledge by use of midnight oil without losing the vital quality.

The student needs, however, as I have just intimated, something besides power to discern and interest in discerning. He wants something beyond the capacity for observation, namely, capacity for generalizing. He needs, I mean, to be trained in seeing data in relation, in perceiving general laws, in historical or evolutionary apprehension. Superior minds perform these intellectual operations spontaneously; ordinary minds must be —and fortunately can be—led to perform them and to enjoy performing them. The teacher has thus two tasks—to train the student to perceive and to train him, further, to generalize.

If the student is told too much at the start, he learns generalizations passively or prematurely, and is likely to be a poor or a prejudiced observer; whereas, if he does not get beyond the scope of his own senses, his education, even though concrete as far as it goes, will be deficient in depth and comprehensiveness.

In any given subject the student requires therefore an actual experience, sufficient to enable him to acquire concrete knowledge which can be built out by reading or by experience; sufficient to enable him to acquire the practical skills needed to extend or to apply his growing body of knowledge; and he must form the habit of generalizing, so that he will put together the details of his experience, directly or indirectly acquired.

II

Three methods of teaching the laboratory sciences are generally employed—the didactic lecture, the demonstrative lecture or demonstration, and the practical exercise. Generally speaking, all three are employed in all countries and in all the laboratory subjects; but they play very different parts in different countries and different subjects; and instruction is more or less satisfactory and effective, accordingly.

The well-conducted practical exercise, in which the student is intelligently but not too strictly guided, ought to be the backbone of instruction, in so far as conditions as to time, equipment, and personnel permit. I say, "intelligently but not too strictly guided," for it is easily possible either to furnish too much supervision, whether in the form of persons, syllabus, text, or chart, or to set up a "practical exercise" so as almost, if not quite wholly, to eliminate the chance of failure. It is difficult to estimate just how much—or how little—the student gains by looking at a section through a microscope which is fully adjusted, or touching a button, or pressing a spring which sets off a chain of events sure to run their appointed course. On the other hand, time being limited, and many ex-

periments complicated, the student cannot be left to do everything for himself, for the chances are that too often he would fail to procure the opportunity to observe, which the experiment is designed to furnish. Chaos, arising from total lack of assistance and supervision, while perhaps educationally preferable to too conscientious regimentation, is not for most students a profitable employment of time.

The practical exercise, properly conducted, enlightens the student in respect to the technique by which scientific data are obtained; sharpens his powers of observation; trains him in inductive power; teaches him the nature of evidence—the infinite superiority of verifiable fact over dogmatic or authoritative statement; gives him a sense of reality with respect to the particular science with which it deals; finally, may even reveal to him the fascination of experimental inquiry—perhaps "the most godlike thing that men do." [2]

But the practical exercise, no matter how abundant, cannot alone furnish the student with a knowledge of general principles, any more than it can give him a comprehensive grasp of the scope of the several sciences. The teacher's exposition must assist both. The teacher must fire the student's imagination; he must expound the general principles, without which practical exercises are but detached exploits, each perhaps pointing a lesson, but not, all together, fusing into a whole. Two methods are open to the teacher: he may, and indeed should, freely utilize as the basis of his exposition and generalization the student's own experimentation; but, to a large, though, in the several sciences, varying, extent, he must employ the demonstrative lecture or demonstration. In the former instance, the amphitheater enables him to explain and to illustrate in systematic fashion; in the latter, he interprets to smaller groups whatever material is available from laboratory or clinic. Both are objective, in a sense passively objective, exercises; that is, the student is told to observe something, which he thereupon looks for. He is, however, immensely more

[2] Bertrand Russell: Essay on *Leisure and Mechanism*.

likely to find it, or to know whether he finds it or not, if a small group is gathered informally about an instructor, than if a large group is seated in a lecture hall, glancing at specimens passed from hand to hand. Demonstration to small groups is, at best, inferior to the individual experiment; but over a wide range it is the soundest method available. How far it is feasible depends in the first instance on the ratio between the number of students and the size of the teaching staff—not to mention the amount of space and material available.

The didactic lecture is as a rule a textbook plus a personality. There are principles that can not be illustrated within the limits of the lecture hour; phenomena too complex to be reproduced, even though some faint approach to concreteness can be obtained through the use of chart, blackboard, or lantern. For the exposition of such, the didactic lecture is the teacher's sole recourse. Again, some students, to whom the printed page alone conveys relatively little, may obtain more vivid impressions if the teacher—the more forceful and magnetic, the better—has previously lent to statement of fact or principle the magic of personality. On occasion, a didactic lecture may break the ice; and the student who would not have read beforehand may review in textbook or periodical what has already been thus explained to him. Obviously, however, the value of the didactic lecture is almost wholly dependent on the vigor and persuasiveness of the speaker. A "dry" lecture is no better than a textbook and may readily be worse. A good lecturer may successfully arouse interest, convey information, and demonstrate broad relationships. In general, however, the student's power of assimilating information didactically conveyed is limited; the saturation point is soon reached. Hence the systematic, didactic lecture, to be effective, must be sparingly employed. On the other hand, the lecture which does what the systematic textbook cannot do—presents, analyzes, and puts in proper historic and scientific perspective typical problems, bringing all the resources of a trained and experienced mind to bear—such a lecture has its

place, an increasingly important one, precisely because of the rapid growth of knowledge and the increased necessity of specialization.[3]

I spoke a moment ago of historic perspective. Medicine has a fascinating history on both the human and the conceptual side. A few professorships in the history of medicine exist in Germany and their endowment in other countries has been urged. In no spirit of objection to the cultivation of medical history as such, one may, however, suggest that the historical spirit is not likely to be created by a series of lectures, if it does not already permeate the thought and discourse of the general body of instructors. A full mind will unconsciously explain present ideas of physiological function and present concepts of different disease entities, from both evolutionary and philosophical points of view. Medicine becomes thus not only a practical profession, but a high intellectual preoccupation. Not infrequently the didactic lectures and clinics on the continent are deeply impregnated with the historical sense;

[3] I find among excellent teachers and investigators great diversity of opinion respecting the usfulness of the didactic lecture. At one extreme, one of the helpful critics of my manuscript comments: "A lecture should never contain anything which the textbook affords." A subsequent critic not less competent comments on my text and on the gloss quoted above as follows: "It may be so. Personally, I think not. Pharmacology is uninteresting—not to be compared with physiology—though the experimental subject is very interesting. Lectures, if well done, arouse interest, help students in seeing relations, estimating relative importance, correlating with other subjects, evaluating evidence, etc. The time is too short for the student to get all of this by himself. He must have help. If the help weakens him—bad; if not—good. X gives many didactic lectures. It does not kill the initiative of his students. It makes them better. The greatest teacher I ever had was Chittenden, who used the didactic lecture a great deal."

Nothing could better show how impossible it is to standardize methods of instruction—so much depends upon what a given individual can achieve by a given method of procedure. The experimental method itself may be a total failure in clumsy hands. It remains true, however, that despite individual variations for which the utmost latitude must be allowed, certain principles of teaching may be made out, though even they must not be slavishly or mechanically followed.

such is, for reasons connected with general education, rarely the case among English-speaking peoples.

III

But effective learning is not merely or mainly a question of the particular methods employed by the *teacher*; it is far more a question of the attitude and activity of the *student*. Strictly speaking, men are, as I have already urged, self-taught. Teachers may indeed stimulate, guide, inspire; but students *learn* more than they *are taught*. I do not wish to underrate the value of sound methods as such any more than, in discussing the curriculum, I wished to underrate logical or sensible arrangement as such. It is assuredly better that the school should provide individual experimentation in a satisfactory fashion, group and lecture demonstrations abundantly, and didactic exposition to the extent needed. But though the wisest adjustment by the school may assist, it will not train the incapable or the inactive student. Still less, will prolonged drill accomplish the desired ends. It may enable a student to pass an examination—an achievement, taken by itself, of doubtful value. But the facts so learned rapidly drop from memory, in the absence of ideas and attitudes which mere drill, representing the teacher's rather than the student's exertion, is powerless to impart. "Your dull ass does not mend his pace with beating." There is indeed a time—in childhood and early youth—when iteration, even punishment, may perhaps permanently imprint a simple lesson or habit. But the type of comprehension required in the practice of medicine goes far too deep to be thus crudely procured. The teacher will use himself up—we shall see that in certain countries he not infrequently does—without converting the listless student into the open-eyed and open-minded practitioner of scientific medicine. The teacher should never be indifferent; but, on the other hand, he ruins himself and does not save his student when he assumes excessive responsibility.

Quite aside from the details to be presented subject by subject, and despite individual exceptions that might be cited, the continental attitude towards the student strikes the observer as in principle sounder than that which is common in Great Britain and the United States. The continental teacher deals with a homogeneous student body, accustomed to work. The university, where the student is free to learn, is sharply marked off from the secondary school, to which he is sent to be trained. In all continental countries, therefore, the teacher of the laboratory branches, devoted, as he usually is, singly, to university functions,[4] does extraordinarily well what is expected of him, but he does not overburden his time or conscience with responsibility for the individual student.[5] We shall see that the methods employed do not always give the student the kind of chance to which the nature of the subject matter entitles him; that is a point on which the several systems will be adjudged at fault. Again, the conception of one or another subject may be somewhat antiquated or ill-adjusted; that, too, I have taken occasion to criticise. Meanwhile, when the continental professor undertakes to give an exposition or a demonstration in anatomy, physiology, or pathology, he usually does it with fullness of knowledge and power. Nor is he likely to be deficient in patience or in interest in the student; on the contrary, most continental teachers enjoy teaching the eager student; they do not think it the business of the university to provide for any other sort. To be sure, occasionally a teacher, interested in research, will fail to present the subject as a whole.[6] But instances of this kind are far too rare to serve as

[4] The case of the clinical teacher is separately discussed in Chapter II.

[5] Excessive freedom in the arrangement of the curriculum has been criticised in Chapter IV. That is another matter, for it concerns things of which the student cannot know enough to decide; as to these he ought to be helped, though not coerced.

[6] Outsiders at times roundly condemn the German university professor on the ground of indifference to teaching; occasionally, harsh criticism to the same effect is heard in Germany. On the whole, in my judgment, the criticism is not justified by either the literature or the facts. German discussion of university theory and purpose fully recognizes the obliga-

an impeachment of the general continental attitude of the university towards the student in respect to his responsibility for himself. Naturally enough, in all countries the student too often lets the golden opportunity slip. He therefore has recourse to drill masters, whom he pays out of his own pocket. To the extent that the drill master flourishes, because of defective teaching and organization, the university is to blame. To the extent that he exists because professors will not do the student's work for him, the university is true to its function. It is a pity that examinations cannot be so contrived as to make the latter use futile.

It is also true that at Oxford and Cambridge and in a very few American laboratories, the student's responsibility is not saddled upon the instructor. But elsewhere in Great Britain and far too commonly in America—even in the strongest universities—the faculty assumes an excessive burden. In the British schools, tutorial classes are officially advertised for the purpose of enabling the younger instructors, at a time when they should not be used up in routine, to coach and drill groups of students for different examinations; and so mechanized is the arrangement that in some schools different tutorial groups are simultaneously being drilled to meet the insignificant differences in the examinations of the several universities. In America, the medical school likewise over-estimates its responsibility for the student's passing. An altogether excessive amount of attention is given to keeping track of attendance, grading

tions imposed on the university by professional training—see, for example, Paulsen, *The German University*, and any one of scores of inaugural and other addresses dealing with the different subjects, their place in the medical curriculum, the best methods of presenting them, etc. Biographies and memoirs of great teachers and investigators give the same impression—an impression confirmed, in my case, by observation in many universities and in different faculties. As far as I am able to judge, the same holds of Holland, Switzerland, and Scandinavia—countries which, like Germany, unite research and teaching in their conception of the university. It is, as I shall show, not the teacher's interest in teaching, but the forms in which teaching is frequently carried on, that one may fairly—at times severely—criticise.

students, recording marks, checking up, reviewing and supervision—in general, to doing his work for him. After four years in the secondary school and from two to four years at college, the medical student who needs to be "controlled" from day to day, sometimes from hour to hour, has mistaken his calling. And this is especially the case in institutions whose equipment and teaching methods meet every sound requirement. As I have already observed, mediocrity and inferiority probably reach in the United States something above their natural level; but without doubt the staff is more or less unworthily consumed, at the cost of the best students, and to the loss of medical science. In all conscience the use of sound methods ought to be enough; it ought to be left to the mature university student and his family to profit by them or not—at his and their peril.

IV

The teaching of anatomy more nearly follows a pattern than that of any other subject. In all countries—excepting only the wretched commercial schools now almost extinct in the United States—the student dissects; in all countries, demonstrative lectures and demonstrations are given; almost everywhere, the didactic lecture plays a part. But the three forms of teaching are variously combined; and the teacher's bearing towards the student varies considerably. Great variations also exist in respect to the part played by histology and embryology, respectively.

The scientific value of dissection is beyond all praise; and it is no accident that medical education did not begin to organize until, little more than a century ago, dissection by the student himself took the place of the more elegant demonstration by the professor or prosector. But dissection itself must be viewed from two angles: (1) the amount required, (2) the degree of the student's responsibility for working out his own problems. As to the former, dissection has been too little modified by recent developments in medicine. In most countries,

students are still required to dissect as much as in the days when there were no other avenues to knowledge of the human body. In Sweden, for example, one is told that every student is expected to dissect the entire cadaver three times. Protests in Germany, Great Britain, and America against the useless squandering of time upon excessive dissection, and on badly distributed emphasis, have had altogether too little effect. In consequence, the student's attention is riveted on inconsequential minutiæ of structure and form, when something could be saved for other purposes. Unfortunately, instructors rarely see beyond the confines of their own subjects. The anatomist does not in this respect differ essentially from the surgeon or ophthalmologist. But, as a matter of history, the anatomist once possessed the pre-clinical field alone; hence, if he can be got to view the curriculum as a whole made up of adjusted parts, there is more for him to surrender than for any other person. An occasional anatomist is equal to the sacrifice: thus Mall greatly reduced the relative dimensions of the subject as a whole, and redistributed time and emphasis by giving to histology, embryology, and special studies a considerable part of the time previously assigned to dissection; and he also took over something of the work previously assigned to physiology.

Instructors vary enormously in the amount of supervision given to dissection. On the continent, generally speaking, individual supervision is not overdone; the student has to work out his own salvation. In France, an explanatory lecture lasting thirty minutes precedes the dissection, where the student works without excessive personal control; but Roux-Berger complains that he follows much too mechanically the textbook that lies beside him.[7] The subject continues to be viewed as handmaid to surgery, the younger instructors being mainly surgeons in training—a condition that is bad for anatomy, which does not develop, and bad for surgery, which should lean not

[7] J. L. Roux-Berger: *Reflexions sur l'Étude et l'Enseignement de l'Anatomie* (La Presse Médicale, March 1, 1913). This criticism is equally applicable to other countries.

only on anatomy, but on physiology and other sciences. In the United States where, in some schools, assistants are more numerous in comparison with the size of the student body than anywhere else in the world, the student at times works under such close surveillance that an assistant all but guides his hand. The work is most stimulating and helpful, not necessarily when it is most deftly performed, as it may be under the condition just mentioned, but when carried on under easy central guidance, in an atmosphere redolent of scientific ideas. A given student might have momentarily acquired more facts or have made a neater preparation in some other way; but his capacity for observation, thinking, and reading would inevitably have suffered.

The demonstrative lecture, illustrated by special dissections, models, lantern slides, and now by radiographs, is employed in Germany, Scandinavia, a few English, and the best American schools to deal with parts which the student cannot satisfactorily make out from his dissection—the lymphatic and nervous systems, for example. At a few places, the radiograph is used with small groups to show parts in relation, changes that take place with age, movement, functioning, etc. Munich is a conspicuous example of an institution where the demonstrative lecture seems to have encroached on the dissecting room; for the student body is so large relative to the capacity of the dissecting room, the size of the staff and the number of cadavers obtainable, that dissections and demonstrations by the professor with an ingenious projectoscope appear to be unduly substituted for the student's own efforts.

Systematic didactic lectures on general principles and relations have perhaps still a place in the teaching of anatomy; but assuredly a very small one. If this be true, the didactic lecture is greatly overdone in Scotland, in the less progressive English schools, in France, occasionally in Germany, and in many American schools.

Embryology and histology usually employ the methods that obtain in anatomy. It is a curious fact, however, that in coun-

tries where they are represented by a full professorship, the student rarely handles fresh material. In France and Sweden, for example, he listens to a course of lectures illustrated by screen projections and examines with a microscope slides already prepared; it is his business to verify a plate or description, to be able to draw and subsequently to identify a structure. Wherever the subject has been transferred from physiology to anatomy, numerous fresh preparations are made by the student during the course, as is commonly the case in the better American schools.

The situation as to the teaching of anatomy may be thus briefly summarized: everywhere, more or less adequately, the logical methods of teaching are employed: the student works actively, he observes under exposition what he can not himself do or imagine, he listens to explanations of what cannot be concretely exhibited. But in the amount of time devoted to the subject, in the elimination of the relatively unimportant, in transfer of emphasis to the more important—e.g., from bones to the viscera—and in the development of a functional view of structure, anatomical teaching has not yet by any means generally adapted itself to modern needs. In many countries, the student dissects too much and too mechanically, and in others, the demonstration and demonstrative lecture should be increased at the expense of didactic teaching. As to the substance of the teaching, the foregoing account of methods must be taken in connection with the account of conception and equipment given in the preceding chapter. As a rule, the teaching is more formal and structural, and less physiological, the more closely it adheres to the old-fashioned dissecting room, and the more freely it employs the didactic lecture.

V

A happy adjustment has been most nearly struck in the English method of teaching physiology and biochemistry. Typical experiments performed by the student himself represent as

far as practicable the entire field on both physical and chemical sides; the equipment is adequate; supervision is intelligent without being parental; coöperation takes place, two or three students working out together the details of the more complicated or elaborate problems; there is opportunity for such fumbling and blundering as is educative; and such reasonable assurance of ultimate success as is requisite to the student's interest and profit.

Obviously, however, many classical experiments are too difficult or costly (time, energy, and outlay all considered) to be performed either by the student or by groups of students; these are demonstrated by the professor. The laws which restrict vivisection do indeed create a vexatious situation, but the method of decerebration devised by Sherrington has proved the salvation of the physiological demonstration. Finally, textbooks or lectures are employed to fill out the gaps left by the practical exercise and the demonstration, and to expound principles at which the student could not himself arrive. A few outstanding teachers succeed in interesting their best students in the literature—even the original sources.

It is interesting and important to observe that the English adhere to the practical features above outlined, regardless of the numbers to be handled or the meagerness of financial resources. The London hospital schools are mostly moderate in size; and they have at their disposal very limited funds. Physiological teaching is, however, carried out in the fashion just described. Cambridge, Edinburgh,[8] and Glasgow are large schools, their students running into the hundreds; but no one dreams of curtailing the practical exercises of the student or over-developing demonstrative and didactic lecturing by the professor. At Cambridge students are simultaneously engaged in doing individual work in physiology and biochem-

[8] At Edinburgh practical work in experimental physiology, biochemistry, and histology was given in 1919-1920 to a class numbering over 400 students; with the shrinkage in the enrollment since that day the classes in 1921-1922 were in each of the practical courses approximately 250.

istry. The staff is small, but the management is at once simple and effective. The class is divided into two groups—an elementary group of about 180, a more advanced (intermediate) group of just over 250.[9] Three days weekly, the elementary group attends demonstrative lectures lasting an hour and spends the following two hours in the laboratory at practical work. For the latter purpose the class divides into sub-groups of approximately 80 each, doing, respectively, biochemistry, frog work, and histology, each individual getting one practical exercise in each of the three subjects weekly. The intermediate group is similarly handled. The few demonstrators move about informally, giving a reasonable amount of help and explanation. The provision of space and equipment is far from luxurious. It is obvious that practical work can be managed, if only the staff knows how.

The practical features of the English scheme were introduced into America as rapidly as the way was opened. From the first they were employed in the department of biology of Johns Hopkins University; their practicability was greatly enhanced through the introduction of standardized forms of apparatus, devised by Porter of Harvard, with the result that a teaching laboratory of physiology can now be as readily equipped as a teaching laboratory of chemistry. In quick succession chairs of physiology have been thus diverted from the didactic to the demonstrative and experimental point of view. The process of modernization is, however, not yet entirely complete. Nevertheless, the installation at the leading American

[9] Out of these large numbers, the most promising are detained a year or two longer for special work; their number is on the average twelve. They "come to the informal tea parties with all the research workers, senior or junior, in the place, for the friendly discussion of work going on, and this intercourse is no small part of their training," writes Sir Walter M. Fletcher in a letter.

I cannot emphasize too strongly the importance of just such selection accompanied by informal fostering of the able student; for this reason I labor the point. It is not only good for him and for science, it is the best way of setting a stiff pace for the ordinary student, far more effective than any sort of regimentation or accounting.

institutions surpasses in point of convenience and extensiveness that to be found anywhere in the old world. The American staff is, in some instances, larger—partly because American students are, as has been pointed out, too closely supervised, partly because excessive attention is so often paid to the feebler students, partly because of the American's passion for attending to details in mechanical and standardized fashion, which, though denominated "efficiency," might better be regarded as unfavorable to the higher efficiency. Meanwhile, in all candor, one must add that a decreasing, but still more or less considerable, number of schools teach the subject in mechanical, lifeless fashion from textbooks, rehashed in didactic lectures, enlivened in some instances by a projection apparatus. In this respect, as in others, the best American examples equal what is to be found elsewhere. But in range of quality, in distance between best, inferior, and worst, no country in the world resembles the United States.

On the continent, except, perhaps, at the small institutions, of which Bern and Amsterdam are excellent examples—for there, despite scant support and inadequate equipment, the professors contrive to carry a practical course—practical work shrinks in both scope and relative importance. It is limited in Sweden, practically non-existent in the medical faculty in Denmark.

In Germany time enough is perhaps allowed; a "praktikum" is generally required in both physiology and physiological chemistry; but its execution is too often perfunctory and sometimes mechanized, and its subordination is attested by the fact that, instead of being correlated with the lecture courses and supervised by the professor, it is given disconnectedly in a different semester and by other instructors. To all intents and purposes, the subject is demonstratively and didactically expounded. For this exposition as such no praise is too high. The attendant [10] who assists in setting up the experiments to be shown is a man of humble origin and limited education; but he has

[10] *Diener.*

held his post for years; his pride in the laboratory is keen; he shines in the reflected glory of the chief for whom his respect merges into reverence. The professor himself is usually a master of the art of exposition. He deals incidentally but effectively with the history of his subject; he expounds the bearings—scientific or practical—of the principle he undertakes to illustrate; he talks with vigor, often with eloquence; charts, models, and reflectoscope supplement the demonstration. All that art and skill can do to vitalize the subject is done in the best of the German physiological lecture rooms; but the instruction is still inferior in effectiveness to the British instruction previously characterized. Several reasons are assigned for adherence to the unsatisfactory arrangements: lack of equipment, impossibility of providing practical experimental courses in large universities, absence of real need for practical work by the student. In the palmy days of the German universities, the equipment could assuredly have been procured. The truth is that the Germans have not realized either the importance or the feasibility of practical work in physiology by the ordinary student; and the financial dependence of the professor on fees has been a serious obstacle to the introduction of individual practical work; in consequence they have not grappled with the problem of organization involved. There is, as I have said, no lack of criticism by the Germans of the defects of their medical instruction; but the remedies suggested fail to touch the vital point, viz., the excessive prominence of the demonstrative lecture, to which the professor mistakenly adheres as the only way of maintaining unity in presentation of his subject.

Least satisfactory of all is the situation in France. Nowhere was more done during the nineteenth century to develop the science: one need only recall Magendie and Claude Bernard. But the medical student has hardly participated. The two savants above named worked and taught outside the medical faculty. General laboratory equipment is slight and antiquated. The facilities for practical work by the student are poor at

Paris, Lyons, and even Strasbourg; better, though not adequate, at Nancy. Even frog work, done for one year by the students at Paris, has now been discontinued; in biochemistry, there are ten set exercises of practical character. Occasional demonstrations are indeed made—a few to the entire class, as many perhaps to smaller groups;[11] but in the main the lectures approach the didactic type—so much so that attendance can safely be highly irregular, as indeed it is. I myself recently witnessed a lecture in experimental physiology in which even chalk and the blackboard were but sparingly utilized; I was told by the professor that no other method was possible, since, where the class is large, a demonstration cannot be seen, and there exist no facilities for work with small groups or individuals. A textbook and, at a pinch, the services of a drill master, will see the student safely past the examiners; and a descriptive knowledge of this character equips the student on the physiological side for his simultaneous clinical studies, to which all the sciences are consistently subordinated.

VI

Four sub-divisions make up the department of pharmacology—materia medica, prescription-writing, toxicology, and experimental pharmacology.

To the teaching of materia medica little attention needs to be given. It is practically a review of the contents of a textbook, illustrated by the exhibition of specimens passed along the benches in bottles or boxes, or held up to the view of the entire assembly by the instructor. The student thus sees what a drug or an herb looks like; he is told something of the conditions for and under which it is to be employed, and what its effects are or are supposed to be. Fifty years ago

[11] The regulations provide that on payment of a fee a student can repeat for himself in the research laboratory the experiments demonstrated to the class; but up to the time of my visit no student had taken advantage of the opportunity.

Huxley, with his sound instinct for the detection of educational futility, proposed to "abolish it altogether." The amount of time still devoted to this almost wholly ineffective, not to say positively harmful, instruction varies greatly; the subject looms large in conservative institutions in Great Britain, France, and the feebler schools of the United States and Canada. The student, however, soon sensing its futility, absents himself freely unless his attendance is "controlled," as it is too likely to be in American institutions. To be sure, the physician ought to be informed about the drugs that he uses and that others speak about; but not everything that is more or less important needs to be separately taught. Such facts and perceptions respecting the origin and appearance of drugs as are of value may well be acquired incidentally as the student works his way through pharmacology and the medical clinic.

In the same fashion, prescription-writing and pharmacy, to which a few lessons must be separately devoted, can be practically acquired incidentally in the medical clinic, and subsequently, during internship. Much that must still be learned is due to the survival of complex methods of prescribing that are now obsolete. With the increase of demands in all directions, something must be cast overboard; and these subjects are surely of minimum educational importance.

Toxicology and experimental pharmacology may profitably be considered together. Both are underlying sciences. Their general principles and questions as to how drugs enter the tissues, are distributed, modified, eliminated, must form the basis of instruction in therapeutics—though therapeutics will not really be well taught, unless clinical teachers, well trained fundamentally, teach the subject at the bedside.[12]

With the relegation of materia medica to an incidental position, there is less place for the didactic method in pharmacological teaching. The demonstration, and, as far as time permits, the individual experiment are mainly valuable.

[12] At Stockholm, however, the subject is, against the judgment of the incumbent, placed entirely with the theoretical branches.

Curiously enough, Great Britain, which has done so well in physiology, and through Fraser, Lauder Brunton, Cushny, and Dale has made important contributions to pharmacology, has failed to develop widely practical instruction; probably because the subject as such has not in theory freed itself from practice and attained the rank and scope of an institute or laboratory. It is handled through demonstration and individual equipment at Edinburgh, Cambridge, and University College, Kings, and the Royal Free Hospital, London. At Glasgow, there is neither practical nor demonstrative work—only didactic teaching. The British medical student, well grounded in physiology, thus usually studies materia medica and therapeutics didactically, just as he did in the pre-physiological era. Indeed, materia medica has by no means been eliminated, even where modern pharmacology is taught. Generally speaking, in France, the subject is limited to materia medica, pharmacology hardly existing as an independent experimental science. Traces of an experimental attitude are, however, visible at Paris, where an *agrégé* gives twenty-five demonstrations, using mice, rabbits, and frogs. At Strasbourg, the present incumbent follows the German method, shortly to be described.

In Germany, pharmacology fares as does physiology. Every university has its institute for teaching and research; and research is highly developed, especially on the chemical side. To these German institutes, busy for over a half century with pharmacological investigation, critical and creative, and to laboratories in other countries, largely staffed with men trained in Germany, progress in scientific therapeutics has been mainly, though, as we have seen above, not wholly, due. Occasionally, too, pharmacologist and clinician join hands in both teaching and research. But the instruction remains on the demonstrative basis. The undergraduate student finds almost no opportunities for practical work. Meanwhile, the demonstrative lecture is admirable; and the inquiring atmosphere that pervades the university institutes and clinics does something in

developing the student's critical sense despite the lack of practical training. Moreover, the sterile humdrum of materia medica is usually reduced to modest proportions. Dutch, Danish, and Swedish pharmacology is derived from Germany and has generally continued its methods; but at Utrecht and Leiden, practical laboratory courses are now being developed.

Perhaps the most efficient and stimulating teaching of pharmacology is found in the small number of high-grade schools in America. Well-demonstrated lectures give a general view of the field of toxicology and pharmacology; concurrently the action of important drugs is experimentally tested by the students, individually or in small groups. As illustrative of the tendency to offer advanced opportunities (which, curiously enough, one encounters in America, where too often schoolboy devices and regulations are abundant in university schools of medicine), occasional instructors go even beyond the practical course in which the student performs the classical experiments, and set a group of students a minor problem which, under proper supervision, they work up, precisely like a piece of research. A keen group already trained in physiology, pathology, and biochemistry may thus, under sensible guidance, gain considerable insight into the technique and aim of pharmacology. Such developments, in the spirit of the seminar long used in the university pursuit of humanistic subjects, go far to bring together the professional and university aspects of medical training.

Pharmacology may be cited to illustrate what I have urged as a fundamental principle in medical education. It is perfectly clear that within the limits of a medical curriculum a comprehensive course in experimental pharmacology illustrating either demonstratively or practically or by both methods all the medicinal agents which the student will employ, and will see employed, is absolutely impracticable. Fortunately, as I have already pointed out, a general attitude that will affect the student and the practitioner can be established by a reason-

able amount of observation and practice, easily capable of being further extended through reading and discussion. The teacher of pharmacology has therefore in his demonstrations and his practical course to convince the student concretely of the specific and far-reaching effects of certain classical drugs. When the student has once learned this lesson—that these agents work in roundabout methods, that they produce definite and often unexpected results and that their efficiency bears little relation to the uncritical theories of the pre-pharmacological days—his critical and observant attitude towards medication should be once for all established. Clinicians of the right type—this is a point to which I shall have occasion to draw attention in the next chapter—will strengthen this attitude by their own cautious and critical use of drugs, and their careful elucidation of the way in which a given agent produces an effect, if effect it does really produce. The students through reading will then acquire further knowledge, at once concrete and critical. Thus the careful, systematic, and coöperative doing of a selected group of experiments will provide the student with an experience which will be extended by his studies in experimental pathology, in the clinics and throughout his subsequent practice.

VII

Quite as obviously as pharmacology, pathology and bacteriology are at once fundamental and clinical sciences. Both, as I have already pointed out, extend in scope far beyond the hospital; and both require, especially from the standpoint of medical education, the intimate hospital relationship upon which I have previously dwelt in one connection or another. From the point of view of teaching, I may go further: pathology cannot be taught to best advantage—it cannot be taught without serious drawbacks and makeshifts—unless the subject, broadly organized as at once a descriptive, comparative, and experimental science, is housed, as of right,

in an institute which is geographically part of the hospital plant and which is conducted by a professor who is ex officio pathologist to the hospital.

These conditions are invariably met in Germany, Holland, Switzerland, Denmark, and Sweden—more or less rarely in other countries. We may then at once conclude that in the countries mentioned alone do the conditions for really effective teaching exist. How far the instruction makes sound use of them is another matter. In Germany, for example, I have pointed out that, unfortunately, the experimental or physiological side has not been generally developed in the pathological institutes. The instruction is therefore almost wholly morphological and histological. It is nowadays quite generally conceded that, largely in consequence of Virchow's overshadowing prestige, partly, too, because of the heavy burden due to the making of autopsies, the morphological side is overdone. Krehl at Heidelberg and others have indeed directed emphasis to the physiological side; but their activities have not generally affected the pathologists, so that the student of medicine continues to give relatively excessive attention to the autopsy, the fresh specimen, and the jar brought from the museum. It is, moreover, the very purpose of the close hospital relationship that the autopsy should be made and fresh specimens studied in the light of the clinical records. A generation ago this was commonly done; but with the preoccupation of the clinician in other directions, "the good old custom" is less conscientiously observed; so that, too often, the German student pursues his excessively morphological study as if it formed an entity by itself.

On the demonstrative side the instruction leaves little to be desired. The principles of the subject are systematically and broadly expounded and illustrated; gross material, fresh and preserved, is passed around the class; drawings and pictures are projected on a screen; slides are exhibited; at the close of the lecture the student is free to examine things at closer range; while the post-mortem room gives daily abundant, addi-

tional, non-systematic opportunities for exposition and illustration.

In respect to active participation by the student, the situation is hard to characterize. Practical courses in making autopsies, working up material, writing a protocol, or studying fresh material, general or special, are offered, sometimes, especially in smaller universities, by the chief himself; more frequently by assistants and *Privat-Docents.* In these courses, the student may apparently get individual opportunity with reasonable supervision; but it may also happen that, attendance outrunning facilities, the practical course shades off into a demonstration by the instructor. Lubarsch, who is now head of the pathological institute at Berlin, practically concedes the point in a recent essay,[13] by no means lacking in candor: "To arrange the instruction, as it is arranged in the microscopic, demonstrative, and diagnostic courses, in which the professor discusses general principles before the entire class while exhibiting the main points to small groups, so that every student is personally supervised, requires not only extraordinary love of work and teaching, but is for other reasons difficult to put through at the large universities; for it would require that the number of instructors should mount with the number of students and the number of students attending practical courses be limited."

Even as it is, however, the eager and determined student need not suffer; he can get the material, and the instructor is usually delighted to answer his questions, direct his attention to the literature, and discuss his problem with him. But it may also happen that the less aggressive student suffers through no fault of his own; while others—in large universities probably a very considerable number—pass through their medical studies with little or nothing beyond demonstrative instruction in morbid anatomy, except in so far as the form and pressure of the examination in pathology compel the student somehow, at the university or some other pathological institute, to acquire a

[13] Loc. cit., pp. 55-56.

minimum of practical knowledge at least. In microscopic pathology, he often receives sets of slides, which he studies and draws, after the lecture in which they have been discussed with the aid of the lantern. Still further, as volunteer,[14] he may, while yet an undergraduate, attach himself to the institute for a period varying from six weeks to three months and thus obtain the most effective and stimulating instruction possible. Of German teaching it may therefore be said that on the demonstrative side it meets in morphology and histology all the essential conditions, while on the practical side the results depend largely on conditions—partly on the attitude of the professor and his assistants, partly on the amount of work that has to be done for the hospital, partly on the size of the student body, but, most of all, on the initiative of the individual student. Naturally, the situation is more favorable in the smaller than in the larger universities; for in these the hospital routine is lighter, and the student comes more readily into personal contact with professor or assistant.

Except for more regular attendance on autopsies by clinician and students, the Dutch arrangement runs practically parallel with the German. Pathological anatomy dominates. In other adjacent countries, variations in teaching method are perhaps of less consequence than are the variations in organization. Thus at Stockholm special and general pathology are represented by separate professorships. Under the circumstances, unity of direction must be difficult to procure. On the other hand, it would appear that individual work is more effectively provided for both in Denmark and in Sweden than in Germany; it is required in the sense that no student can escape it. At Stockholm, for example—and something similar exists at Copenhagen—the student is expected to attend post-mortems for a period of ten months, the extent of his participation depending on his zeal and ability; small groups attend the post-mortems; and opportunity is afforded for the making of microscopical sections.

[14] *Famulus.*

The accessory position of pathology in Great Britain acts as an insuperable obstacle to the proper teaching of the subject. In the first place, pathology and medicine begin together, as a result of which pathology never stands on its own feet. Experimental instruction is undeveloped, though provision has been made for a biochemical division in the Department of Pathology of University College, London. Except at Glasgow, the theoretical pathology of the medical school and the practical pathology of the hospital form two geographical parts; and though at Manchester, Edinburgh,[15] and University College, London, efforts to bring about unity have been made, they cannot be said to have taken shape in an institute of pathology. The teaching is concrete and individual. By means of demonstrative lectures, general principles are explained and illustrated, fresh material from the hospital, museum specimens, and lantern slides being freely used; and the classes are so organized that every student is carefully trained in the recognition of the common lesions. Latterly at Edinburgh and Manchester, the case system has been introduced in order to link the teaching of special pathology and clinical microscopy with the teaching of medicine. The student is furnished with a résumé of the clinical history of a case and the findings of the autopsy; he is then required to give an account of the case from the anatomical and pathological points of view; he is thus led to study the material and to consult the authorities. In addition, he is painstakingly drilled in the observation of museum specimens—rather too much so, for the examination spectre looms too prominently in the foreground; he also serves an autopsy clerkship and pursues practical courses in clinical microscopy. In themselves these features are good as far as they go. But they do not go far enough. In essence they constitute a training that is of inferior value unless

[15] The professor of pathology is now, by agreement between the University and the Royal Infirmary, ex officio pathologist to the infirmary, but as in the other places mentioned, his laboratory is in the medical school; hospital and school facilities have not come together or been amplified.

closely linked with the study of all the other relevant data of their respective cases.[16] Occasionally—one may mention as an example, and not the only one, the clinical unit of St. Bartholomew's—laboratory and bedside findings are ascertained and interpreted together; but in many of the schools effective correlation is not systematically achieved. A second defect goes even deeper: instruction, so practical in intention and so concrete and definite in method, needs to be counteracted or supplemented by deep and productive scientific activity. But, partly as a result of history, partly as the result of existing conditions, such scientific activity has thus far been only sporadic in the field of pathology. The pathologist, serving the hospital, concentrates his teaching efforts on the immediate needs of the medical student, and is fortunate if he is in position to investigate problems of practical rather than fundamental theoretic importance.

"The business of a department of pathology in a medical school," writes Professor Dean, "is to teach the sort of pathology which every medical man ought to know." This is indeed one of its functions and cannot be neglected; but as its eye has been fixed too narrowly on this obvious truth, the subject has in Great Britain remained for the most part a tool of clinician and surgeon, to the despair, for the time being, of a few pathologists of larger vision.

Far less satisfactory is the general situation in France, where theoretical teaching, largely didactic in character, goes on at the faculty, while the practical work—the doing of autopsies, the study of fresh specimens—takes place in the several hospitals without central control. At the faculty the student hears much

[16] This sort of thing was once almost universal in the United States, where the student did urinalysis in a chemical laboratory, but not for patients in the wards. Of some schools this or something like it (hardly in the case of urine) may still be said, but in the better American schools, much "clinical microscopy" is done by interns and students in laboratories connected with the wards. Thus pathology and bacteriology as sciences are freed from this particular routine, and the routine is closely connected with the individual patient, as it should be.

and sees end results—museum specimens or a projected slide; but nothing is done in his presence or before his eyes. His own participation is limited to handling a jar or looking through a microscope. At the hospital, intern and extern may participate to a greater or less extent in the activities of the hospital deadhouse—varying with the interest of the staff from no autopsy at all, a careless autopsy by a green extern to a thoroughgoing one by a good assistant.[17] But there is no adequate provision for the ordinary student. A student might graduate without ever even seeing a post-mortem done. Special courses of a practical nature are offered; and many students take advantage of them. In these, the ordinary student receives the best part of his pathological education; but in no event is the subject presented to him as a whole; and between the theoretical exposition at the faculty, the autopsy in the deadhouse, and the patient's record in the ward, the gaps are unbridged.

The sole exception to the deplorable conditions generally existing in France is Strasbourg where the existence of a pathological institute has stimulated a totally different type of teaching. Unification exists; the professor commands the material. Hence his lectures, the deadhouse, the fresh material from the operating theater, and the clinical records are all organically related. The student is brought into immediate contact with all in the person of the professor and his staff. He helps in the autopsy room, may prepare slides, studies fresh material—all under the supervision of the instructors who have expounded the principles of the science in the amphitheater. It will be interesting to observe the influence which Strasbourg exerts on the position of pathology elsewhere in France.

In America, the situation is rather more complicated and uneven than that in respect to the rest of the curriculum. Consider, for a moment, the facts as respects the essential portion of the subject: a few medical schools (a dozen more or less) possess

[17] Thus, in one Paris hospital, the autopsies are done by externs, who, to quote, "spoil everything"; in another, by an assistant, formerly an intern, who, on a nominal salary, spends his mornings in the deadhouse.

institutes of the German type, that is, departments of pathology lodged equally in the medical school and the hospital, conducted by a professor who is pathologist to the hospital because he is professor in the university; a few more have a similar organization on paper; but the medical school with its teaching department may be in one place and the hospital with its deadhouse in quite another; others have a professor who is nominally a hospital pathologist, while, in fact, an instructor of inferior rank, usually a young surgeon, conducts the deadhouse in his own way—sometimes well and sometimes very poorly; finally, there are schools without even this shadowy relationship. In the group first named, those like Harvard, Yale, Washington University, the University of Michigan, Johns Hopkins, and McGill, the instruction is in point of organization and management superior to anything in the old world; for it combines didactic teaching reduced to the minimum, demonstrative teaching to small groups who follow in succession the most important lesions abundantly illustrated,[18] regular pathological conferences, in which pathologists, clinicians, and advanced students meet, and finally individual work by the student precisely as in physiology. The museum is usually less elaborate and less freely utilized than in Great Britain. There is, at times, also a relative inferiority to some English and continental schools in the number of autopsies; but perhaps this lack is compensated by the more thorough study of the smaller number of post-mortems, owing to the prominence given in teaching as in research to chemical and experimental studies.

The next group of schools—Cornell, Columbia, and Chicago, for example—conceive the subject and plan the instruction on paper precisely as do those above mentioned. But lacking a pathological institute in contact with the clinics they are forced

[18] The superiority of organization is not without its own peril: for these rapid transits, each furnishing a bird's-eye view, may mislead the student or standardize the amount of instruction imparted; they will harm him unless he leaves the successive stages stimulated rather than satisfied—keen to learn and to do more.

to devise expedients of one kind or another. There is always danger that the instruction will fall into two parts—the theoretical and experimental portion, given at the medical school; the autopsy and special portions, given at a hospital. Fortunately schools of this type are rapidly being converted into unified institutions.

As for the rest—a large group numerically—it would be mere repetition to speak at length. They vary from schools in which a serious cleft between medical school and hospital exists down to schools in which didactic lectures, illustrated meagerly or not at all, prepare the student for an examination rather than introduce him to a comprehensive science.[19] Once more, the best that America offers is perhaps the best to be found, and the poorest is unapproached for feebleness by the worst that exists anywhere in the countries with which this volume deals. Numerically taken, the best are still none too numerous, but they are steadily increasing alike in number and importance.

In addition to the university institute of pathology, linking clinics and medical school, institutions are sometimes fortunate in forming relations which greatly increase their supplies of autopsy material. Thus in Berlin, the pathological institutes of non-university hospitals are in charge of titular university docents—quite independent of the university pathological staff —who offer to students excellent opportunities for work and study, in groups and as individuals. In the United States the two Philadelphia schools, each possessing its own soundly organized department of pathology, divide between them the enormous autopsy service of the city hospital, which, indeed, is in immediate communication with the medical department of

[19] The University of Toronto is in this situation: the department of pathology occupies a plot, immediately adjacent to the Toronto General Hospital, where most of the clinical teaching is carried on, but the pathological staff of the school is not ex officio the pathological staff of the hospital; the gap is bridged because the hospital pathologist, chosen by a joint board, is placed on the school staff. The arrangement cannot be regarded as sound in theory.

the University of Pennsylvania. The coroner's material and Bellevue Hospital, New York, enrich equally the three medical schools, none of which, however, as yet possesses an institute of pathology of the proper type. At Harvard, the affiliated group of hospitals, constituting the university clinics, affords a large supply of material, augmented formerly by the resources of the Boston City Hospital and still to some extent by those of the Massachusetts General.

VIII

The remaining subjects—bacteriology, legal medicine, and hygiene—call for little comment from the standpoint of teaching method. Bacteriology is usually taught in close conjunction with, and in America prior to, pathology and clinical microscopy; in Great Britain and in the best schools of the United States well-illustrated lectures and a series of practical exercises carried out by the student are employed. In France the usual type of lecture is given at the faculty; at Paris a few practical lessons are given to large groups who have in a previous semester attended a lecture course given by the practising physician, who is professor of bacteriology; but optional practical courses are available at the Pasteur Institute or in the clinical laboratory of a hospital. At Lyons the institute of hygiene has been developed in the building of the medical faculty and a course lasting two years is addressed to medical students, students of pharmacy, veterinary medicine, and inspectors. Similarly, at Strasbourg the head of the Pasteur Institute is professor of bacteriology, and practical work for the department, the making of sera, the training of health officers, research, and the instruction of medical students in bacteriology and public health are inextricably intertwined.

Legal medicine is demonstratively presented in Germany and France; the incumbent at Paris is a full-time expert; in some of the smaller French universities, Nancy, for example,

the professor in charge is also a practitioner of medicine and official expert; yet such is his enthusiam that he has, with small means, gradually made an extraordinarily interesting collection, beautifully arranged and kept, and his lectures and demonstrations attract students in large numbers. The subject is cultivated at Edinburgh, and at Guy's and St. Bartholomew's in London, but it is practically ignored in the United States.

Hygiene varies enormously.[20] In Germany, England, and Sweden, didactic and illustrated lectures are given; in Germany, and in Sweden at Stockholm and Upsala, institutes of hygiene exist in the medical faculty; in France, the subject is largely absorbed by bacteriology; in the United States, it figures in the main indirectly—in bacteriology and internal medicine, and more important still, in a change of view, gradually perceptible, which tends to permeate the entire medical school with the thought of preventive medicine. Chairs of hygiene have, however, been established at Yale, Harvard, Columbia, Cornell, and Vanderbilt, and schools of public health, on a par with their respective schools of medicine, are being developed at Pennsylvania,[21] Harvard, and Johns Hopkins.

IX

The preceding account makes it clear that there are abundant opportunities for reform and improvement in laboratory teaching. The defects are various: in Great Britain, instruction is —physiology being the general exception—likely to be too practical or too didactic; in German countries, too theoretical. It must become adequate in both the practical and the theoretic sense. Money is, of course, needed; but money is by no means

[20] I speak here of hygiene as a topic in the medical curriculum, not of instruction in hygiene designed for persons entering the health service. Hence the text takes no account of such courses as lead to the "diploma in public health" (D. P. H.) in Great Britain.

[21] The head of the department gives instruction in hygiene to medical students.

the sole or first consideration. Unity of conception is the first requisite; next, the resolute determination to introduce in all the laboratory subjects the principles worked out in England for teaching physiology would effect enormous improvement without any expenditure whatsoever. Thus far, however, except in the best American schools, there is no agreement on the fact that all the medical sciences should be similarly taught—that is, that pharmacology, biochemistry, and other subjects are on principle to be taught as anatomy is now generally taught, both practically and demonstratively. Reform projects, at the moment most abundant in Germany, fail to include this fundamental feature. It is safe to say that neither additional lecture courses, additional years, nor any other of the teaching devices proposed in actual or suggested reforms either in Great Britain or Germany—in France there is less discussion—will greatly modify present results; nor will the better organization and facilities of the best American schools produce anything more than a good average result, until in good faith we adopt from the continent the essence of university freedom, and from England the essence of the honors course, viz., the early selection of the most able, and their careful fostering by masters interested in science and in them.

CHAPTER IX

THE CLINICS

A—CONCEPTION AND EQUIPMENT

I

Hospital and laboratories are discussed in separate chapters merely as a matter of convenience; for the hospital should be the laboratory of the clinical teacher, and the conditions essential to the physiologist are equally material to the teaching and research of the internist. Theoretically, this point has long been conceded; actually, it is still far from complete realization.

I have argued that, without stopping to quibble as to whether it be a science, an art, or both, medicine has accepted the fundamental criterion of science, for it is pledged to the critical scrutiny of facts, as far as our powers aided by every known device can carry us. A modern physician may indeed fail to describe accurately and thoroughly an abnormal condition; he may be guided by chance or tradition in the selection of therapeutic procedure; he may be mistaken as to the supposed efficacy of the agencies he employs; in any event he understands that it is his business to observe accurately, that he ought to know from study and experience why he pursues his chosen course and what he expects from it, that he should watch to see whether his analysis of the situation and his practical steps are borne out by the progress of events; and if ignorance and inexperience—whether merely personal to him or common to the profession—limit accuracy and definiteness, he should be acutely conscious of that fact.

In the explicit form which I have just used, the scientific

conception of medical practice cannot be said to have been universally held anywhere fifteen years ago. But unquestionably the clinical teachers of the universities of Northern Europe had, on the whole, gone furthest in that direction. They were, by reason of training, status, and facilities, most nearly of a piece with the teachers in the so-called medical sciences. Thoroughgoing study and teaching from the pathological and occasionally from the physiological standpoint by organized groups chosen primarily for the purpose and equipped with all possible paraphernalia were typical of the universities of Germany [1] and the countries usually classed with her, and to the same extent typical of no other country. And this was just as true in surgery, gynecology, and pediatrics as in internal medicine. The "clinic" of the German, Austrian, Swiss, Danish, or Swedish professor was the counterpart of the "institute" of the anatomist, the physiologist, and the pathologist. He had his staff, the members of which largely, in some instances wholly, devoted their time over a stretch of years to teaching and research; he had his laboratories—chemical and biological—for current work, for research, and to some extent for the teaching of the student; he had himself been originally trained in pathology, chemistry, or physiology. But, though the scope of the laboratory was far broader than contemporaneously in any other country, one might perhaps fairly say that, on the whole, the laboratories were viewed merely as aids or supplements—indispensable and important, to be sure—to clinical activity. The point cannot be pressed too far, partly because even in Germany clinicians varied in inclination and emphasis, partly because one must be careful not to draw sharp lines when the facts can be truthfully represented only by careful shading.

As compared with the German conception of medicine, just outlined, medicine, I mean, as primarily a clinical activity immediately buttressed by biology and chemistry, British medi-

[1] The same conception was, and is, in Germany, embodied in certain non-university clinics, e.g., in Berlin, Dresden, Düsseldorf, etc.

cine of the same day was overwhelmingly clinical. Simple laboratory procedures, mainly carried out in the pathological or bacteriological laboratories, were more or less generally employed in diagnosis and treatment; but there was in general medicine or surgery nothing like an adequate assertion of the part that might be played by the free use of biological or chemical technique. The leading clinicians were good morbid anatomists; a few had been well trained in physiology; but as clinicians they lived on their past, drifting away from the deadhouse and without contact with experimental physiology.

In France, the general situation closely resembled that in Great Britain; but occasional exceptions of really modern type, such as Widal's clinic with its well developed research laboratories, had been created. In America, medicine and surgery could only be described as chaotic. It was overwhelmingly clinical, and in most places, on old-fashioned, not to say obsolete, lines. Adequate training in gross pathology was comparatively rare. Between the other laboratories and the clinics, if clinics the wards may be called, there was very little connection. Signs of progress were, however, not wanting. At least the clinical laboratory, utilized for diagnostic and teaching purposes rather than research, was rapidly being introduced; in a few places, especially wherever Osler's influence had made itself felt, the autopsy was carried on in close intimacy with the wards. In Baltimore, surgery was also viewed from the experimental point of view. Thus a distinct group, interested in introducing into America the German method of viewing disease as at least involving the application of laboratory methods to clinical problems, was forcing its way to the front.

II

For the study of disease and the training of students patients are needed under complete control in hospital wards and under partial control in the ambulatorium or out-patient de-

partment. If the point of view is merely clinical, adequacy of supply is the main consideration; to the extent, however, that laboratory methods play a part, differentiation of material must be carried further, laboratory facilities are needed, and contact with the fundamental sciences becomes increasingly fruitful.

A decade ago the material situation corresponded closely with the various points of view which I have characterized. Each of the German universities possessed under the control of a professor separate and generally adequate clinics in medicine, surgery, obstetrics and gynecology, pediatrics, psychiatry, and the various specialties; every clinic had its necessary laboratories—chemical and biological—its animal house, photographic and X-ray outfit, and library. The clinical institutes, as nearly as possible, adjoined one another and, what is equally important, adjoined, wherever feasible, the laboratories in which the fundamental sciences were cultivated. The medical school was thus geographically a unified whole, the several parts of which functioned independently, though not without marked influence on one another. The clinical institutes were of the same type as the institutes of physics, chemistry, and biology—all independent, all substantially adequate, and all engaged in teaching and research. Differences of scale and elegance of course existed. At Berlin and Copenhagen, the clinics were new and splendid, as was the surgical clinic at Zurich, the surgical and neurological clinics at Utrecht, the children's clinic at Vienna—by way of example. At Würzburg, Munich, Stockholm, and Bern, the buildings were old, the equipment, of various dates and quality. But the conception behind was so nearly the same that the professor not infrequently preferred the antiquated makeshift of Bern, Munich, or Vienna to the up-to-date facilities which he might have acquired by going somewhere else. Whatever the outward appearance, clinical medicine was prosecuted and taught with whatever aid could be derived from pathology, bacteriology, chemistry, or physics, as they then existed.

I have said that for the study of disease and the training of students the university must completely control an adequate supply of clinical material. The universities of Northern Europe met this condition in a variety of ways, none of which, however, impaired either completeness of control or adequacy of supply. In Prussia the entire university, including the hospital in which clinical teaching was carried on, belonged to the state; the hospital was therefore a university hospital, in the same sense in which the laboratory of physics was a university institute; a professor in the medical faculty had the same standing in his clinic, the same authority, the same rights, as the professor of physics had in the laboratory of physics and for precisely the same reason, namely, because the state had created and was supporting both to serve higher education and research. To the administrator [2] — the rough equivalent of the American superintendent—were delegated administrative functions; but it was his business to make things work easily and smoothly for the professional staff.

Outside Prussia, the external relationship varied. Some clinics were municipal, others provincial, still others were endowed. Occasionally, the several types—state, provincial, municipal, endowed—were pieced together to form the "university" clinics; in the largest centers, university and non-university clinics in medicine or surgery existed side by side in the same large hospital. To greater or less extent, a similar external diversity existed in other North European countries. Thus in Stockholm, the "Serafimerlasarettet," which supplies the faculty with most of its clinics, was originally endowed; but its resources are supplemented by the state, the town, and the department; the children's clinic was in part endowed, in part supported by the municipality.

Significantly enough all this made, from the functional point of view, no real difference. The professor had his beds —as many as he needed, and sometimes more than he needed;

[2] *Verwalter.*

the system of admission was designed to enable him, as far as practicable, to select material valuable, in his judgment, for educational and scientific purposes; his laboratories and his library were properly supported, whether by the state or some other agency, or by both; and he taught as he pleased. Conditions in all these essential respects were so uniform that distinguished clinicians, called from one university to another, migrated freely from a clinic owned by the state to a clinic owned and supported by a municipality. For complete and unfettered university control was so firmly established and the prestige of the university faculty was so great that, once a hospital or clinic entered into relations with the university, the scope of the university faculty was never questioned or abridged. Minor questions arose, to be sure, where money was involved—as to the number and pay of assistants needed for teaching rather than for mere hospital service, or as to the cost of laboratories, used mainly for research rather than for routine work. But the adjustment was rarely difficult, and in any case not different from the adjustments between departments which are from time to time necessary within every teaching institution.

The practical objects aimed at in Great Britain could be well enough obtained, provided simple, routine laboratories were furnished for elementary teaching and provided, further, the school had access to large hospitals containing abundant patients. In London the two sets of facilities were, generally speaking, compact—though not invariably so—because the schools grew out of the hospitals. Moreover, the teaching staff enjoyed great freedom in the wards, because they were members of the hospital staff before they were clinical teachers—not staff members in virtue of appointment to teaching posts. School control existed in Great Britain, but it did not really mean educational control. The hospitals in question were general hospitals, meant primarily for medical and surgical cases. As a result, the material was, though abundant enough, poorly differentiated and usually mixed—a condition that is

not good for teaching and is fatal to research. Thus, at Edinburgh there were seven surgical and eight medical divisions, each with forty to fifty beds. Cases of every description were found in every division. The beds were too few, yet the routine too heavy, for anything but the required teaching. Medical and surgical cases were divided among too many disconnected physicians and surgeons; modern pediatrics was, except in Glasgow, unknown; neurology was scattered through the medical beds; psychiatry was undeveloped except in connection with the already insane; obstetrics and gynecology were variously disposed of. Many schools had to carry on their teaching in one or more of these branches in detached special hospitals. In point of equipment, the institutions were all defective. A deadhouse and a clinical laboratory represented the most they possessed in the way of teaching facilities. Regular equipment for research was beyond their sphere. Scotland and the provinces differed from London only to the extent that more commonly the hospitals used were still more scattered, though, by a fortunate design, at Edinburgh, the school and the Royal Infirmary were close together. There at least an integrated plant existed.

In France the situation was on the whole of similar character, and for the same reason: for the French, like the British medical school, was concerned with producing doctors, not with medical science or with education of university quality. The Paris hospitals were either huge, scattered general hospitals, ill-equipped, beyond a deadhouse and teaching rooms, or equally huge and scattered special hospitals, one for diseases of the skin, another for obstetrics, still another for chronic or for mental diseases. Rebuilding had been started; and a few splendid modern clinics—well equipped for teaching and research—had been constructed. But the general level was not affected by the disconnected, even though excellent, provision made for a few strong men. Outside of Paris, the same conditions prevailed. Occasionally, as at Nancy, the hospital adjoined and was monopolized by the medical school; but nowhere

was a teaching hospital in the sense of a group of university clinics to be found.

The American situation was chaotic and to a considerable extent discreditable, not infrequently scandalous. The term, "teaching hospital," was coming into use, but teaching was very rarely so prominent, active, and systematic as to determine the construction, equipment, and conduct of an institution. A few universities did actually own or control university hospitals—even so, hospitals rather than clinics—the Universities of Michigan and of Pennsylvania, for example; Michigan, indeed, had long imported outsiders to important clinical posts; the control at Philadelphia was, however, ineffective, for the local profession held most—not all—of the posts [3] on the basis of professional prominence rather than educational service. As a rule, the superintendent exercised more power than the professor. Moreover, the few institutions which possessed teaching hospitals also utilized additional hospitals or hospital services of the scattered type that I shall in a moment describe.

At Baltimore, a deliberate effort had been made in the direction of the German conception of university control in the interest of education. Johns Hopkins Hospital was a separate corporation from Johns Hopkins University, though with an overlapping directorate. The founder had, however, wisely expressed in his will the wish that the hospital for which he had made provision might serve the needs of the medical department of the university, when established; and the trustees of both institutions had loyally and intelligently coöperated in giving this brief instruction a broad interpretation. Small services had been provided for medicine, surgery, gynecology, and obstetrics; other important elements were, however, absent, except as represented in the out-patient department. In the early days, a clinical laboratory was equipped for the teaching of students in connection with routine work in the wards. As

[3] Among the exceptions, for example, may be cited Dr. Osler, called from McGill University, Montreal, to be clinical professor of medicine—a straight-out educational appointment.

far as appointments were concerned, the entire hospital was under university control. An active and productive department of pathology linked the services together, and a laboratory of experimental surgery flourished in modest quarters. The equipment, outwardly imposing, was, nevertheless, far inferior to the German clinics of the same era; yet it was in organization and personnel far in advance of other American establishments.

A numerous group of medical schools carried on their clinical teaching in affiliated hospitals, sometimes general, sometimes special, scattered through their respective towns, which could by no stretch of language be called clinics. At the best these hospitals were infirmaries of the British type; they were comfortable, at times luxurious, boarding places for the sick; but science and education had had practically nothing to do with equipment, organization, and conduct. There was therefore little sympathy and less interplay between laboratory and clinical teachers, where there was neither geographical nor educational unity. Schools in the same community vied with one another in capturing hospital facilities by giving school appointments freely to physicians and surgeons already holding hospital posts, thus completely reversing sound procedure, with the result that clinical teaching of the kind to be described in the next chapter was going on scrappily in a dozen or fifteen, sometimes more, general or special hospitals. Generally speaking, the opportunities in surgery predominated—a fine proof of the lack of educational purpose. I should in fairness add that in a few places, by reason of comparatively prolonged contact, a tradition in favor of deferring to the medical school was beginning to harden. Thus, the Massachusetts General Hospital had a fairly definite, though not complete, relationship to Harvard, and the Presbyterian Hospital at Chicago a sympathetic connection with Rush Medical College; but hardly anywhere, as recently as a dozen years ago, was the bond firm enough to bear much weight. Effective control, exercised in the first instance by the

school, whether as a matter of right or custom, was practically unknown outside of Baltimore and Ann Arbor. As a result, clinical teachers of university grade hardly existed, because they could not be trained, and because, further, they could not have been placed, if they had been trained.

It is perhaps hardly necessary at this time to add that the foregoing description applies to the better schools of, say, 1910-1912. Nothing need be said of the rest, now fast becoming extinct, which had only a shadowy connection—sometimes merely a nominal connection—with hospitals that were either poor in quality or so largely private that they offered no teaching opportunities worthy the name at all. These institutions simply housed sick people, at times under wretched conditions; they were without autopsy facilities, clinical laboratory, records, or library. Even the simple practical objects which were aimed at by medical schools in England were utterly unobtainable in them. The teachers were busy practitioners, usually graduates of the schools in which they "taught." At the lowest depths, reached in various towns throughout the country, conditions were simply fraudulent.

III

In endeavoring to express any change that has taken place in the conception of medicine during recent years I am, of course, comparing the most advanced positions of the two periods respectively. Medicine progresses with a very uneven front; the front line fifteen years ago was, outside of Germany, thinly held, and in Germany itself was not perfectly straight. The front line today has advanced beyond the point then covered; but numerically it is hardly more than a reconnaissance. Behind it every variety of practice and theory that has ever existed still exists; only the proportions vary, and, on the whole, vary in the forward direction.

I have said that the most advanced conception of a decade ago regarded a medical clinic as made up of wards with which

were connected chemical and bacteriological laboratories. The laboratories are today more varied and elaborate; but the difference lies not in extent of laboratory equipment, but rather in a subtle quality affecting relationship. It is difficult not to over-emphasize the distinction, but I may perhaps not be misunderstood if I repeat what I have already said, viz., that the scientific clinician of the generation just passing viewed his laboratories as ancillary; they provided him with tools, with methods, with technique, to be utilized as supplementing clinical observation and experience in studying disease, treating patients, and training students. Unless I am in error, the barrier, however tenuous, implied in the words, "ancillary" or "supplementing," has in these latter years been pierced. Anatomy, pathology, physiology, chemistry, and physics are no more tools of the clinician than they are tools of the pharmacologist; they are becoming the very essence of both medicine and pharmacology alike. Clinical observation is not *interpreted* in the light of facts ascertained in the adjoining laboratories; facts from whatever source derived fuse to create the concept or picture of disease. A complete account from every point of view—anatomical, bacteriological, pathological, chemical, physiological, clinical—cannot possibly be the work of one man. But precisely here the change that is coming over medicine is perceptible; for anatomist, pathologist, physiologist, and chemist do not merely report to the clinician; they form with him a group; they study their problem together; he is simply *primus inter pares.*

A curiously complicated situation results. I have pointed out what this development means for medicine, a combined and unified attack on the unknown, a combined and unified presentation to the student of what is known. It is, however, equally important to realize what it does not mean. It does not mean that the so-called medical sciences, bacteriology, for example, even if included in the medical faculty, are at all limited by considerations connected with the clinic. The moment that happens they become once more subordinate, and

are on the way to comparative sterility. Simultaneously with their special developments in one or another of the medical clinics, according to the predilection of the staff at the moment, every one of them—pathology, bacteriology, physiology, etc.—must be independently cultivated, comparatively and experimentally, without immediate reference to the teaching of students. Side by side, independent development as science and progressive integration in the elucidation of medical problems must both proceed.

The point of view just indicated is held by a few of the younger men in Northern Europe. England is still slowly making its way toward the conception already widely attained in advanced continental countries a decade ago. France has undergone no noticeable change within the period in question. Greatest progress has, however, been made in America, where a sharp stimulus has been derived from research institutes—notably the medical clinic of the Rockefeller Institute. In the last few years, half a dozen medical clinics have thus been expanded and reorganized on lines that are a step in advance of the position taken up by the German clinicians, of whom directly or indirectly the American group may fairly be regarded as pupils.[4] A similar situation exists in America in pediatrics, which, as distinguished from the child welfare conception now developing in Great Britain and quite common in America, has been developed at Johns Hopkins, Washington University, Yale, Cornell, New York University, by men heavily indebted, directly and indirectly, to Czerny, Finkelstein, and Pirquet. If these men have made any contribution to medical thinking and practice at all, it is in the complete integration of facts regardless of the technique—clinical or laboratory—by which they may be obtained. For them there is no question as to whether clinical observations or laboratory results have precedence—all are alike "observations," in the obtaining of which the senses, aided and unaided, are active;

[4] As this is written a professorship of medicine at Copenhagen has been similarly filled.

and not only the senses of one person, but the coöperating senses of a competent group or team.

IV

From the standpoint of progress in equipment, one has little to report in Germany, largely, perhaps, because a decade ago its material equipment already expressed the view of that day —still so nearly the advanced view of our own time. New hospitals and laboratories continued to be constructed up to the outbreak of the war, but they did not differ in principle from hospitals and laboratories already abundant. The type may be characterized as that of independent, self-centered clinics, each with its appropriate laboratories for research, and all meeting in the pathological institute. But the clinics were hardly intimate with one another nor with the laboratory branches except pathology, though the compact and unified plant and the possession of the same university ideals made them powerful co-workers in both education and research. Of countries occupying the same standpoint, it is interesting to report that hospital reconstruction on a large scale has been undertaken at Lund, Upsala, Leiden, and Copenhagen. The Copenhagen plant is a splendid embodiment of the conception of separate, contiguous institutes in easy reach of one another, the several clinics being each properly supplied with laboratories for routine analyses, for the teaching of students, and for research by the professor and his staff; whereas, unfortunately, the Leiden clinics, dispersed over a large terrain, are too inaccessible to one another. Plans had been made for a new medical school and hospital at Amsterdam. Everywhere, however, in these countries, reconstruction was stopped by the war.

In France, the new hospital in which the university will carry on its medical teaching is nearing completion at Lyons; but its remoteness from the university and the laboratories of the medical faculty is sufficient proof that it does not embody modern ideas as to the relationship of medicine and the medical

sciences; in Paris, progress in reconstruction practically halted on the outbreak of the war. In Great Britain, the most important addition to teaching facilities existing in 1912 is the reconstruction of University College Hospital which will for the first time in Great Britain equip a medical and surgical clinic with modern requirements for teaching and research. As a unique exception to the lack of differentiation that still generally obtains, Sir Thomas Lewis possesses there a genuine cardiac clinic of fourteen beds with all the equipment necessary for research—and for this small clinic, by the way, he finds "full time" in the strictest sense, inadequate rather than otherwise. Improvised additions of distinct promise have also been made at St. Thomas's and St. Bartholomew's, so as to give research opportunities to the members of the newly established units.

V

It is but recently, as I have already shown, that in America effort has mainly been directed to procuring contiguity of the laboratories *and* clinics; today the struggle is directed to procuring the laboratories *of* the clinics. I have already stated that in Germany, fifteen years ago and more, disease had attained the status of an entity—an object of experimental as well as clinical study by the clinician, and requiring for such study not only patients but laboratories. The laboratories in question, representing usually simply the training and interest of the professor, played a relatively small part either in the routine study of all patients or in the routine teaching of all students—both of which were carried on in the general institutes of pathology and bacteriology. In America, as I have also pointed out, a somewhat different development had taken place; for here, in immediate connection with the medical wards, clinical laboratories had been developing for general diagnostic and teaching purposes; thus all patients enjoyed such benefits as laboratory diagnosis could confer, and students

in the best schools could study their patients simultaneously at the bedside and in the adjoining laboratory. For these two purposes, the clinical laboratory connected with the wards was equipped to do mainly bacteriological and chemical work. Diagnosis, treatment, and teaching were mainly the functions of the laboratories in question.

With the growing, even though still limited, acceptance of the notion that it is the function of the university clinic not only to treat patients and to train students, but to investigate disease, the clinical laboratory of the past decade has proved inadequate. It has, of course, not lost its place or importance—for it is still needed for diagnosis and for the training of students in methods. But as matters now stand, neither independent nor coördinated departments of pathology, bacteriology, and biochemistry can take the place of research laboratories in the clinic equipped for the study of the problems found in the clinic. A development resembling that found in Germany, but, as we shall see, going in some instances considerably beyond it, is thus taking place in America and is just beginning to show itself in the British units: that is, the clinics are beginning to procure their own research laboratories, in addition to their routine and teaching laboratories, just as pathologist and biochemist have long possessed research opportunities in addition to teaching facilities. The avenues that approach disease are indeed as numerous as the spokes of a wheel: physiological (and this chemical, physical, or physical-chemical), outright chemical, finally biological (and this bacteriological, parasitological, morphological, embryological, or genetic). The German research clinical laboratory was apt to concentrate on the particular approach that was congenial to the professor; the newer American types are more varied, less stable, and all different. It is obvious that limitations in respect to money and men make schematic completeness and uniformity both impracticable and undesirable. The clinics are therefore bound to vary with the capacity of the chief, with the type of assistants procurable, the character of the material, and the funds available. Nor

can any one of them permanently remain just as it now happens to be. From time to time, workers will be forced from one field into another; and as personnel changes and ideas are worked out, some lines will be dropped, others taken up. Thus, at the moment, one medical clinic assembles a group of workers, one of whom is interested mainly in metabolic and chemical problems, another, in infectious disease, the third in problems of respiration, the fourth in cardiac conditions. Each group has its requisite patients and laboratories. Other groups or individuals interest themselves in additional problems—tuberculosis, syphilis, etc. The divergent activities must be coördinated by the chief—with a light touch, to be sure.

The organization of clinics of the type described presents many problems. Specialism tends to become tangential—yet the needs of treatment and teaching and often of research require that from time to time the threads be brought together. Duplication is unavoidable, yet resources—both financial and human—being limited, every clinic cannot become a miniature medical faculty. It is a question of judgment as to when the clinician is to appeal to the physicist, physiologist, or biochemist rather than develop further himself or his staff on the physical, physiological, or biochemical side. And, on the other hand, it is a question of judgment how far physicist, physiologist, and biochemist may be diverted from their own problems to coöperate with the clinician. Both things will happen: men, reaching the end of their rope, will retreat, study, and return to the attack from other points of view. A clinician, primarily interested in a purely clinical problem, may thus find himself forced back into pure chemistry; not finding a mode of attack already to hand, he will be compelled to devise one; returning to his clinic, he will have to adapt his method to a biological problem; he will be fortunate if he is not thereupon compelled to make a physiological adaptation, before he is fully equipped to attack the clinical problem with which he began! Even so, the road is not likely to be straight or smooth; whether in any particular instance further training of the clinician, or co-

operation with chemists or physiologists, or both, should be relied on, depends on circumstances. Generally speaking, cöoperation is more easily arranged in the newer American schools than in either France or Germany, where the several units have a long history of independence. But, obviously no rule can or should be laid down: the situation should be flexible and varied; the pendulum may well swing towards one side in one institution or department, towards the other, somewhere else. The very instability and variety of the adjustment reached, if it is solid, controlled, patient, thoroughgoing, is favorable to fertile research, to stimulating instruction, and to resourceful care of patients. But judgment is needed—increasingly sound judgment as organization and responsibilities become more complicated and active.

VI

The amount of clinical material required—in-patient and out-patient alike—depends obviously in part on the size of the staff, in part on the number of students; on reflection, it will be clear that it depends also on the method and theory of instruction. If, for example, demonstrative methods are alone or mainly used, fewer patients are needed; if thorough study of certain types of cases is made rather than a superficial and comprehensive effort to "cover the ground," carefully selected material is more important than mere mass. Something also depends on the rapidity of the turnover. A clinic in internal medicine or pediatrics must, other things being equal, be larger than a clinic in obstetrics or ophthalmology.

The medical faculties in Germany, Austria, Switzerland, Holland, and Denmark possess, as a rule, the requisite number of differentiated clinics, with a reasonable, sometimes even an excessive number of beds, compactly brought together under complete university control. Medicine, surgery, and pediatrics have 100 beds or more apiece, obstetrics and psychiatry 50–75, the various specialties 30–75. In France, the material is

enormous in quantity, but differentiation and control, in the university sense, defective; in Paris, dispersion destroys organic unity. The same is true of Amsterdam. In England, there are in medicine and surgery usually patients enough, as a rule, in the hospitals immediately connected with the medical school; but the hospital organization is such that no instructor possesses beds enough, and those he possesses are too miscellaneous to afford sufficient material for study. The clinical units are, through a process of gradual consolidation, promised more; thus the medical unit at St. Thomas' (London), now 40 beds, will increase to 60; and they are virtually still further increased and somewhat specialized through the courteous cooperation of the rest of the clinical staff, who at times deflect cases to the persons particularly interested in them. Similar and even more marked developments are taking place or are in prospect in other hospitals. Pediatrics, with the exception already noted, does not in the modern sense exist [5]; and the facilities for teaching and investigation in obstetrics are uneven, scattered, and therefore, educationally, quite beyond university control.[6] Clinics in other branches are non-existent; but occasional specialties are separately cared for, as is neurology at Queen's Square, London. At Edinburgh, the number of beds available is, as compared with students enrolled, distinctly limited, and teaching methods have had to be adapted to meet the comparative shortage.

On a paper showing, many American schools appear to possess material enough—that is, if the beds in the hospital services in which teaching is carried on are simply counted; but the showing changes radically, if we eliminate, as we should, "affiliated" hospitals or hospital services, in which the

[5] There are, however, 78 beds for children at the London Hospital.

[6] A modern obstetrical clinic is under construction at University College Hospital (London). For details regarding obstetrics and gynecology in Great Britain, see *Notes on the Arrangements for Teaching in Obstetrics and Gynecology*, etc., by Janet M. Campbell, M.D., M.S., issued by Ministry of Health (London, His Majesty's Stationery Office, 1923). An inventory of the same kind should be made in other branches.

footing of the medical school is uncertain, or hospitals which are so far below accepted standards that students are more likely to be harmed than to be helped by them. Even so, the hospitals which in America are described as controlled by the university are rarely so conducted that patients are admitted with some reference to the teaching needs of the student or the investigative needs of the staff. For some of the hospitals are compelled to ask whether the patient can or cannot pay something towards the cost of caring for him, while others, maintained as philanthropies, accept patients as they apply. In respect, therefore, to the amount and character of material, the "clinical facilities" claimed by the American medical school must be carefully scrutinized before one can be sure as to what they really mean.[7] The best conditions are found in a small number of institutions, among which, by way of example, Harvard may be said to possess adequate clinics in medicine, surgery, pediatrics, and psychiatry; Johns Hopkins, small clinics in medicine and surgery, adequate clinics in pediatrics, obstetrics, psychiatry, and a modern urological clinic; Columbia, medicine and surgery; Pennsylvania, medicine, surgery, and obstetrics, including gynecology; Yale, medicine, surgery, pediatrics, and obstetrics; Washington University, medicine, surgery, and pediatrics; [8] Western Reserve, medicine and surgery; Cincinnati, medicine, surgery, and pediatrics. In practically all these instances, hospital and university have, on the basis of contract or understanding, come together so closely that the university possesses the right to appoint the clinical staff, and this right has already been exercised by calling in men of modern training—thus breaking the local hold which confused education and practice.

Of the great state universities, California possesses a modest modern hospital; Iowa is now completing an adequate series

[7] Moderate size is best, if selection can be employed in admitting cases. If selection is impossible, larger numbers are required as more likely to contain what is necessary.

[8] An obstetrical clinic is about to be constructed.

of clinics; Michigan[9] and Wisconsin have built, but not yet opened, the former a commodious, the latter, a modest hospital; other state universities have but started a clinical development of their own—Minnesota, for example, Kansas, and Nebraska. Hospitals connected with state universities in the United States are in a somewhat delicate position. Unless they maintain cordial and helpful relations with the profession of the state, legislative support may be imperilled. They need material varied enough in quality and sufficient in quantity to sustain teaching and research. Beyond this point, they may come into competition with the profession which the state university has itself trained—especially in case of patients able to pay for medical and surgical service. There is no reason to suppose that the medical profession of any state would begrudge the university hospital, at which the members of the profession are mainly trained, the amount of material and the kind of material needed for teaching and research; but if the work of teaching is well done, the practising profession should be able to handle patients beyond those required by the state hospital for educational and scientific purposes. One need not be surprised if a state hospital, which expands beyond this point, arouses the hostility of the profession with which it would thus be in competition.

The Canadian schools do not differ fundamentally: Toronto has access—under something below strictly university conditions—to large medical and surgical services at the Toronto General, and on a less secure footing to the commodious Children's Hospital; McGill to two large general hospitals, neither of which is entirely dominated by university ideals.

Almost without exception American medical schools eke out such clinics as they possess, and improvise teaching of the missing branches, by establishing contacts and relations of every possible variety of educational and scientific efficiency; but, on

[9] Michigan has, however, long possessed a university hospital, with services not only for medicine and surgery, but for certain specialties (e.g., dermatology); it has also long had effective relations with the state psychiatric clinic.

the whole, one is justified in saying that the sort of completeness and homogeneousness, from the point of view of adequacy in number of beds, equipment for teaching and research, educational control, and compactness of plant that is generally characteristic of the university medical schools in Northern Europe cannot today be found in a single university in France (except Strasbourg), Belgium, Great Britain, Canada, or the United States.

VII

In general, from the standpoint of neither teaching nor research, is the out-patient department effectively organized. Its importance is surely sufficiently obvious; to a considerable extent the ambulant patient manifests the process of disease closer to its onset than the patient in the wards. He is therefore frequently more capable of being helped by treatment or advice; to the investigator he offers the chance of contact with causes in action rather than end results. Finally, no small proportion of the young physician's patients will be persons who complain of aches and pains before they are forced to take to their beds.

The relationship of clinic and ambulatorium is satisfactory in outer form in Northern Europe where each clinic has, as a rule, its own out-patient department, administered by an assistant responsible to the chief.[10] Out-patients are thus fed into the wards; they are also utilized in the giving of practical courses. In Great Britain, the out-patient department generally serves the entire hospital; and it is usually conducted by assistant physicians, who send cases into the wards whenever necessary.[11] The out-patient department also, as we shall see, plays a regular rôle in clinical training.

[10] At Copenhagen the out-patient department is separate in medicine, surgery, and neurology; it is part of the clinic in pediatrics, dermatology, otology, and gynecology.

[11] At some hospitals (University College and St. Bartholomew's, for example) senior members of the staff also take their turn in the out-patient department.

In America, once more, the situation is varied in form and quality. A few general as well as a few special hospitals possess commodious, well-equipped, and well-managed out-patient departments, operated, from both student's and patient's point of view, in connection with the several clinics. Washington University is one of the small number of examples that may be cited. Medical, surgical, and special out-patients are handled in immediate connection with the medical, surgical, and special services of the Barnes Hospital; children out-patients in connection with the children's clinic. Not infrequently, however, even in so-called teaching hospitals, the dispensary, as the out-patient department is called, is practically independent, operated by part-time workers, more or less detached from the hospital service.

The practical difficulties in all countries in the way of rendering efficient service to out-patients or giving thorough instruction to students are very grave. The numbers of patients to be handled are enormous; space, facilities, and time are all limited. The work is almost necessarily entrusted to juniors, who drift away from it as their professional activities increase. From an educational point of view, things become worse rather than better, if use is made of scattered local dispensaries, where young physicians and, as at Edinburgh and Munich, senior students acquire experience and minister to patients without equipment, organization, or supervision. Nor is the domiciliary visit of the student, privileged to call in a superior, if needed, likely to be more helpful to either student or patient.

Certain experiments under way have thus far done well. Thus in the New Haven Dispensary and the out-patient department of the Johns Hopkins Hospital, the departments of pediatrics see mother and baby by appointment.[12] The number of patients is thus limited to those who can be carefuly handled;

[12] At New Haven the appointment system is being extended to other out-patient departments, e.g., medicine, the women's clinic, and certain specialties.

the mother's time is saved; intelligent and continued coöperation can be procured; and the student is not positively injured by being a party to slipshod methods. Cornell Medical School (New York City) has abolished its practically free and unlimited dispensary service for a relatively inexpensive service limited to the numbers that can be properly handled.

VIII

Clinical material in sufficient quantity and variety is readily obtainable in large towns. The city is therefore the natural site of the medical school. Meanwhile, by historic accident, universities have not infrequently been located in small towns —Lund and Upsala in Sweden, Marburg and Giessen in Germany, Oxford and Cambridge in England, Ann Arbor, Iowa City, and Charlottesville in the United States. In Northern Europe, it has never been suggested that, in order to obtain clinical material, the medical school, detached from the rest of the university, should be located in a more or less remote city; for the university is known to be an organic community of students and scholars—an intellectual and spiritual entity, the life of which depends on its social unity. True at all times in the past, this is in a still further and perhaps deeper sense true today, when science has established the interdependence of all knowledge. Medicine is in only the most superficial sense a separate realm. The detachment of the medical school from the university in order to have easy access to patients therefore sacrifices the unity of the university in order to accomplish an object that can usually be otherwise attained.

By means of economic and administrative measures [13] which need not be here described, the medical faculties of Northern Europe have solved the problem; they bring the patient to the university. In Great Britain, the effort has, unfortunately, not been made. The Scottish student at St. Andrews leaves

[13] Sickness insurance; a brief statement on the subject will be found in Bulletin VI, Carnegie Foundation, pp. 291-292.

the surroundings, atmosphere, and scientific contacts of the university to pass the clinical years in the infirmaries at Dundee; the Oxford or Cambridge student, having enjoyed the best of opportunities in science, lowers the level of his training when he repairs to London for his clinical experience. There is assuredly no inherent difficulty whatsoever involved in rounding out the medical schools of the historic English universities, Cambridge and Oxford, on the clinical side. In America, this has been satisfactorily accomplished at Ann Arbor and Iowa City; it is about to be achieved at the University of Wisconsin. It could be done at Lincoln, Nebraska, at Austin, Texas, at Berkeley, California, or at Charlottesville, Virginia. There are but few American university towns so pocketed that the problem is probably insoluble.[14] On this point the experience of both Europe and America points to one conclusion: the unity of the university is essential; intelligent legislation and administration can solve the problem of obtaining clinical material.

"The unity of the university," I say, "is essential." When the Johns Hopkins Medical School was built about 1890, contiguity of laboratories and clinics was attained; but it occurred to no one as likely to be perhaps equally important to identify the Medical School with the rest of the University. Fifteen years later the same error was just as unconsciously made when the new Harvard laboratories were built in Boston, instead of Cambridge. With the increasing reliance of all the activities of the medical faculty on chemistry, physics, and biology, and the increasing significance to chemist, physicist, and biologist of the experimental work of the medical faculty, the advantages of unification of all university faculties have become unanswerably plain. This unification obtains, as a rule, by historic accident, at certain European universities—at Edinburgh, for example, and Nancy; it came about naturally in some places in America—in several state

[14] E.g., Fayetteville, the present seat of the University of Arkansas, and Boulder, the seat of the University of Colorado.

universities, at the University of Pennsylvania, at Toronto and McGill; it is designed in connection with the new plants at Chicago, Nashville, and Rochester (New York). Schools otherwise located, whether in towns remote from their respective universities,[15] or, as happens more frequently, at more or less remote points in the same or adjacent towns, labor under a handicap, that can be overcome, if at all, only by extraordinary efforts to widen and deepen the scope of the medical sciences. Meanwhile, it has become clear that the half-school, offering only the pre-clinical branches, the divided school, offering pre-clinical branches on the university campus and the clinical branches in a distant city; [16] and the split school, having its laboratories combined at one place and its clinical facilities scattered through local hospitals,[17] cannot be successfully defended from either the scientific or the educational point of view,[18] even though the remote school may in a few instances have to be accepted, because it is an accomplished fact.

In this connection a word may be said regarding the size of the medical school; for, obviously, neither concentration of laboratories and clinics, nor contiguity of medical school and university is possible, except for a relatively small school. Ideally the size of the medical school unit is settled when one answers a single question: how large a department of anatomy or physiology can a single head administer without abandoning the principles of sound teaching or taxing himself and his staff so heavily that they can neither teach nor investigate effectually? Men vary, to be sure; but it is probable that on the average a hundred students will constitute a fairly heavy bur-

[15] Cornell Medical School, Medical Departments of University of Illinois, University of Nebraska, University of Indiana, University of Texas, etc.

[16] University of Kansas, University of California, Stanford University, University of Aberdeen.

[17] E.g., Paris and many American schools—College of Physicians and Surgeons, New York, New York University, etc.

[18] Most of the London hospital schools are in the same position as the American school remote from its university. But University College is an exception. It is really a unified university, though technically a college of the University of London.

den. On this assumption, the university need then only supply on the university campus laboratories and clinics capable of handling groups numbering approximately 100 students.[19]

Practically, however, the problem is less simple. If, for example, properly equipped, financed, and administered outside clinical opportunities are available—the three conditions are all essential—a certain amount of decentralization on the clinical side becomes practicable. Students who have been soundly trained in the pre-clinical sciences may thus to some extent wander away from the university campus, provided the outlying hospitals are of university type, in respect to equipment and ideals. But there is always danger that the conditions are inferior, for the educational authorities can, and as a rule do, know little of what happens beyond the university campus. In the great European centers—Paris, Vienna, and Berlin, as well as in smaller towns—Amsterdam and Stockholm—in which considerable decentralization prevails,[20] the conditions vary considerably; but on the whole, the men who conduct university teaching in the more remote clinics do not differ in type from those whose clinics are nearer the heart of the university; they do, however, have less contact with other workers—laboratory or clinical. Such contact is always established with difficulty in great cities; it becomes, however, increasingly difficult, as men remove from the center of activities.

In America, outlying hospitals are widely used and on the whole, thus far, with unsatisfactory results. The hospitals are themselves apt to be inferior; their management is apt to be less sympathetic; the clinicians are rarely of academic type; and the conditions of staff appointment and service are generally unsound. As we have seen, in America, clinical appoint-

[19] The problem is easier on the clinical side, since students can be distributed through the various clinics in varying succession. It is important not to be rigid, else we are thrown back on the class system.

[20] In Berlin, e.g., there are four university clinics in internal medicine, two in the Charité, two somewhat farther off.

ments on the basis of university ideals are not yet common, even where the university is in apparent control; the professional rather than the university factor becomes stronger, as the university becomes more distant. Hence, particularly in the scattered hospital services, instruction is apt to be on the clinical level—often of poor quality at that. Yet exceptions that point towards better things may be noted, of which the Harvard clinic at the Boston City Hospital, enjoying, at present, the excellent resources of the Thorndike Memorial Laboratory, is an admirable example.[21]

[21] Decentralized clinics can, however, if properly equipped and staffed, be advantageously used for post-graduate training. This use has been highly developed in Vienna, Berlin, and Paris. See Carnegie Bulletin VI, Chapter XIV.

CHAPTER X

THE CLINICS

B—TEACHING

I

There are no principles involved in teaching clinical medicine that are not likewise involved in the teaching of the laboratory subjects. Against a background previously painted (in this instance, the normal man), the student (be he teacher or undergraduate) employs his senses (aided and unaided) to elicit data that, when put together, enable him to construct a picture, the outstanding feature of which he tentatively labels; the contrast of the two pictures now before his mind's eye (the normal and the abnormal) poses for him a problem for therapeutic procedure. To visualize and solve problems, no two of which are ever alike—that is the concern alike of family physician as of university investigator. To that end, having assembled data, he ventures a hypothesis and undertakes a line of action. If his label—or diagnosis—is correct, and his therapeutic procedure—positive or negative—sound, normality will, wholly or partly, according as human skill and knowledge do or do not avail, be restored; if his therapeutic procedure be unsound, nature will return a negative answer and he may have a chance to try again—unless, as frequently happens, nature takes the matter out of his hands and attends to it herself. In any case, the process involves observation, induction, and experiment, followed by observation, induction, and experiment—indefinitely.

It is to be assumed that in his previous studies the student has acquired a conception of the body in health, a knowledge

of the principles of disturbance and the ability to use certain tools which assist (they cannot possibly supplant) his senses. Henceforth his clinical training is a matter of aiding him to extend, organize, and interpret his experience; and every step in the extension and organization of his experience tells in many directions—increasing his knowledge of the healthy body, thus renewing and enriching acquisitions already made in anatomy and physiology, and adding, one by one, concepts of typical disease processes, every one of which is individualized with all the differences of detail, inherent in individuality. It lies then in the very nature of clinical medicine that it should be taught precisely as anatomy and physiology and pathology were taught. The student must be trained to observe; he must be trained to generalize on the basis of observation. In observation he must employ his eyes, ears, fingers at the bedside, in so far as they can procure relevant data; and in the laboratory, in the examination of such possible bits of evidence as the unaided senses cannot alone unravel. At the right moment the student's knowledge and grasp may be extended by demonstration, and occasionally even by didactic exposition. And when once his mind has been sufficiently trained, his knowledge can be built out quickly and substantially by reading, conference, and discussion. In all this, there is no inherent difficulty. The trouble has really come from the fact that, as I have repeatedly pointed out, medical faculties are rarely of homogeneous texture; modern ideas have come to prevail in the so-called laboratory branches; but, concurrently, clinical teaching continues often to be carried on by men who are, scientifically viewed, in arrears.

There are, then, various ways of teaching clinical medicine, every one of which has its part to play, e.g., (1) the study or observation of the individual patient throughout the whole course of the disease by the student under proper guidance and control; (2) the demonstration of cases by the instructor; (3) the exposition of principles. The different methods, may, of course, be differently combined by different teachers, equally

successful; and, as the student proceeds, they tend more and more to merge in every exercise, whether at the bedside or in the amphitheater. As a matter of history, however, different nations have, as we shall see, curiously devoted themselves with more or less predominant emphasis to one rather than another of the three methods.

II

I take the British method first, because, in its essence and in its possibilities it is, I believe, soundest. I have already briefly characterized the training with which the British student usually enters the clinic: it is, for the most part, shortsightedly practical—too unimaginative to sustain a thoroughly modern clinical structure. And I have also characterized the British teacher of clinical medicine,—with a few exceptions, the significance of which I do not overlook, a practitioner or consultant, intent on practising medicine and training men who will at once be at home with patients, rather than men equipped to keep pace with, or contribute to, the rapid developments of clinical science.

The lines within which British clinical training operates are thus clearly marked at the outset. After a brief and sensible course in physical diagnosis—a recent regulation, though long since in use [1]—the student enters upon a series of clinical posts, in each of which he is in immediate and responsible relation to patients. The hospital services are, as I have pointed out, cut up into small units in charge of a miniature staff—a chief, a junior, and two or three recently qualified [2] assistants. To each such group or firm there are assigned a small number of students, who thereupon become organic parts of the little organization. They have, individually, certain duties to perform in connection with particular patients—the number of beds or patients assigned to each student varying considerably

[1] In a curriculum that has a long tradition much may be done that does not appear in the schedule. This is true in all European countries.

[2] In America we should say "recently graduated."

with the size of the student body and the amount of material available. They go through the motions of the physician—taking histories, making examinations, framing diagnoses, suggesting treatment. They have the run of the wards, being indeed parts of the functioning machine; [3] it is assumed that they will be assisted when in difficulty by a superior and that their work will be checked and controlled by the chief or one of his associates.[4] As rounds are made, the student is confronted by his fellow students and his teacher; after quizzing, the person in charge dilates more or less fully on the case, comparing, explaining, generalizing. As a rule, he does his teaching at the bedside rapidly, superficially, often almost casually.

On the medical side, the student would, in a representative London school, serve as "clinical clerk" for six months, three with in-patients, three with out-patients, and an additional three months as pathological clerk, assisting in bacteriological and pathological work derived from either the ward or the deadhouse. As "dresser," a similar routine is followed in surgery. Midwifery differs, only in so far as the two clerkships (in- and out-patients) run for a month each—the hospital material being for the most part scanty. Similar arrangements exist in whatever other departments the school may possess—diseases of the eye, skin, etc. Altogether the student must now spend at least three years in this fashion.

An English hospital, viewed as a teaching institution, resolves itself into small groups, say from five to ten students, following an instructor—two or three times a week, the chief, on other days, a junior—from bed to bed.[5] Every student is

[3] There is, however, considerable diversity as to the hours during which the wards are open to clerks and dressers: e.g., at University College, London, students have access to patients four hours daily—decidedly too short a period; at Guy's, nine; at the Royal Infirmary, Edinburgh, five.

[4] In practice "checking up" of the student by house officers recently themselves students is not generally very efficiently done; the chief and his junior spend too little time in the hospital to carry on efficient control. The "units" promise better in this respect.

[5] In Scotland, the chief visits the hospital daily; so also at Guy's and of course the London units.

active in connection with "his" own patients; he is an onlooker, not always entirely passive, when his fellow students reach "their" patients. Bedside instruction is, however, supplemented by systematic and usually didactic lectures in every subject, at which, mercifully, attendance is voluntary; and by special demonstrations or classes, usually, however, conducted with an eye to some sort of external examination for which the student is making ready by assiduous "reading." A small proportion of students, having "qualified," receive higher appointments, running six months or a year, occasionally longer, as house physician or surgeon, or assistant house physician or surgeon, etc. The rest—perhaps three-fourths of the entire number—unfortunately begin to practice at once.[6]

The merits of the British system are great and obvious. They are fully appreciated by the British themselves and not unappreciated in other countries. In effect, the British student learns clinical medicine as an intelligent apprentice—an apprentice, I mean, who, in virtue of previous training, is soon capable of orderly procedure in the analysis of symptoms, the arrangement of data, and the drawing of tentative conclusions.

Aside from the inadequate time usually given by the English chief to his teaching and the excessive responsibility laid upon the juniors, the educational defect lies, not in the system as such, but in the spirit in which it continues to be administered, viz., its shortsighted practicality. It is, indeed, as I have previously noted, remarkable how little British physiology has yet achieved in changing the spirit of British medicine. Annually, for years, a group, well trained in physiology at Cambridge, Oxford, and University College, London, enter the

[6] At Edinburgh, clerking is, on account of the size of the student body and the limited facilities of the Royal Infirmary, less highly developed than in London, to which the text especially applies. Edinburgh students receive cases for individual study in rotation, each student thus receiving only two or three cases in a given service, instead of being in charge of certain beds continuously for a definite period. Clinical instruction at Edinburgh consists therefore largely of ward rounds, clinical lectures, and didactic lectures.

hospital schools and with rare exceptions soon settle down to clinical study at a level much below the level of their physiological training.[7] They are indeed lost in the mass of students of inferior preparation with whom they are merged.

Listening to a succession of bedside expositions, not infrequently quite chatty in substance and tone, one is struck by the positive note; this, that or the other indication is pointed out—rarely is the unknown, the problematic, the profounder question, the historic background alluded to. The attending staff of the English hospital could not, indeed, visiting the hospital a few times a week, study cases thoroughly, even if training and facilities were adequate; and the junior assistants are not equal to the load laid upon them. As contrasted with the infinite complexities of the actual process, whether of health or disease, bedside teaching of this type enormously over-simplifies. It hardly penetrates the surface and is apparently unaware of the fundamental activities involved in the phenomena of life. This defect is aggravated rather than corrected by the lectures and demonstrations. The former are too largely expository and add little, beyond the emphasis of the spoken word, to what the student will read in his textbooks. A scientific discussion, in which ideas and the history of ideas are prominent, such as is common on the continent, is rare in Great Britain. The clinical teacher lives within the circle of the immediate, the technical, the practical.

The shortcomings which I have described are by no means unrecognized in Great Britain. A remedy has been sought at Manchester, where pathology has been continued throughout the entire course, an excellent way of making the student realize the inextricable relation of bedside and laboratory. The General Medical Council seeks a remedy through enforced reviews of physiology and anatomy during the latter stages of

[7] The war made a great difference—whether temporary or permanent remains to be seen. Physiologists like Haldane, Barcroft, Hill, Bayliss, and Starling attacked medical problems. Thus physiology obtained problems from medicine, and medicine ideas from physiology.

the student's career, a procedure which will assuredly not make up for lack of really scientific interest on the part of the clinicians themselves.

More significantly, however, in the medical and surgical units in London, the thin edge of the wedge has already been introduced. A full-time chief with ideas can surround himself with a group of young men, who will devote themselves for prolonged periods to the study of disease. Under these conditions, clinical schools may develop. On the teaching side, also, the unit has advantages. In the new laboratories of St. Thomas's, for example, a more thorough and more systematic correlation of bedside and laboratory work is already under way. Thrice weekly, systematic instruction in biological and chemical methods of clinical investigation is given. In addition to examinations of this kind required of the clerks, special cases are assigned to small groups—a stomach case to one group, a case of diabetes to another, a study of kidney efficiency to a third group. The corresponding group in surgery articulates ward visits more closely with gross and histological pathology than is generally the case, though both at Edinburgh and at Manchester efforts in the same direction are made. Research problems are also being attacked in close association with teaching.[8] The hospital staff sometimes look askance, but perhaps more often sympathetically, upon these innovations; they represent, however, merely the beginning of an invasion which has far to go, if the spirit and aim of British medical education are to be brought to the level of contemporary medical science.

Difficulties not to be lightly dismissed are at the moment created by the financial situation, for hospital schools, supported by fees, cannot be reorganized without adequate funds. But there is a deeper difficulty. The Briton prides himself on being "practical"; tradition and vested interest call the new movement "scientific." There is therefore apt to be something apologetic or conciliatory which beclouds the real issue, even

[8] The Medical Research Council coöperates with the units at this point.

in the most vigorous pleas for progress. The truth is that "practical" and "scientific" are, on the showing of the British themselves, identical. Sir George Newman, who may be fairly regarded as one the most effective factors in British medical progress, calls attention in a recent report [9] to the fact that most people suffer from apparently quite simple ailments—tuberculosis, lumbago, anemia, bronchitis, etc. He urges, therefore, that the medical school must train practical doctors who will know what to do with the type of case they are most likely to meet. But, as he proceeds to point out, "backache" is not itself a disease; its diagnosis involves differentiation, to execute which all the resources of science may have to be employed; prognosis and advice are assuredly not easier. "Bronchitis and alimentary disorder are protean in kind and severity." The "practical" doctor is not therefore the doctor who knows and gives a succession of prescriptions for a symptom; on the contrary, the more thorough and scientific, the more practical. But this one dare not roundly assert in Great Britain. Yet nowhere else in the world could the two be so safely identified; for the units, still in their infancy, already show how British medical teaching may be thoroughly modernized without loss of the concrete and practical quality by which for two centuries it has been distinguished.

III

In describing the clinical training of the French student one must distinguish between the part played by the medical faculty and the part played by the French hospital, independently of the faculty. We shall consider the former first.

The clinical education of the French student, beginning on his very entrance to the medical school, consists of a series of stages—i.e., definite periods during which he passes the forenoon in one or another hospital service, under the general

[9] *Recent Advances in Medical Education in England*, London (His Majesty's Stationery Office, 1922,) pp. 68 ff.

direction of the medical faculty.[10] During the first two years, he divides his time equally between medicine and surgery—attending a medical clinic for one semester, a surgical clinic for the second semester of each of the first two years. During the remaining years, he passes through other clinics—obstetrics, ophthalmology, dermatology, etc.

The French clinician arranges his work as he pleases. But commonly first and second year students—and any others who please—assemble in the hospital amphitheater at nine o'clock to listen to a didactic lecture, meant to orient the student so that, ignorant as he is of anatomy and physiology, he may quickly acquire knowledge enough to understand something of what he will experience in the clinic. These lectures touch on the anatomy, physiology, and pathology of the various organs, and are occasionally illustrated by specimens. The entire staff of the clinic participates in giving them. In point of helpfulness they vary considerably: the best teachers endeavor, by clear and simple presentation, in which the French masters excel, to prepare the student, as far as humanly possible, to grasp the carefully selected and relatively simple clinical problems which during the ensuing hours will be presented to him; but there are not lacking ambitious lecturers, who shoot far over the beginner's head, in respect to both the preliminary discussion I am describing and the cases subsequently exhibited.

At ten the class, consisting of anywhere from thirty or forty [11] to one hundred "stagiaires," augmented by visitors, many of them practising physicians,[12] assembles in the wards for bedside instruction. To the "stagiaires" in succession cases have been previously assigned for study. The beginner,

[10] He is notified by the secretary of the faculty that he is to enter this or that stage; he is free to select the clinic which he will attend; if its quota is filled, he must make another choice.

[11] The first year ward classes are large, because the "stagiaires" just beginning are restricted to the few official clinics.

[12] The presence of physicians undoubtedly influences the character of the instruction.

with such help as he can get from intern or assistant, is expected to have worked up an account of his patient. He is at this stage simultaneously acquiring knowledge of anatomy and physiology; he has not yet had instruction in the art of physical diagnosis; this he "picks up," as he goes on, from older students and assistants. In the crowded ward—sometimes so crowded that few can see the patient and not all can even hear the student—the "stagiaire" reads the story he has contrived to prepare, and is cross-examined. The extern and finally the intern, who have each a degree of responsibility for the same patient, are similarly, but more thoroughly, quizzed. Finally, the professor himself takes hold and expounds the case at length. The student is, of course, bewildered at the start, for, ignorant of functions and organs in health, he cannot know what is and what is not pathological. The better instructors choose cases with care and guide the "stagiaire" with infinite patience; but there are not wanting those who believe that it is best to throw the student into deep water that he may the more strenuously endeavor to swim. In either event, the "natural" method, as I have called it,—the method of learning by experience so extensive that slowly things sift and classify—gradually enlightens him as to differences and their significance. It is argued that in course of time the originally chaotic impressions sort themselves out in orderly fashion and that, what with daily fumbling and watching, the student learns ultimately to take care of himself and of his patient.

In the second year, the large groups break up, as the students scatter among both official and unofficial clinics. Moreover, from now on both the instruction at the faculty and the increasing experience in the hospital become gradually more helpful to him. The daily ward discourse is supplemented by lessons and demonstrations of a more intimate and practical character. The several clinics vary, however, considerably in their ability to add laboratory instruction to the bedside exposition. There is always a deadhouse; but the autopsies, usually made for each of the services separately by an intern, still an under-

graduate student, may or may not add something that is sound and thorough.[13] The clinical laboratory facilities are at best far too limited to accommodate the "stagiaires". There exist, for example, excellent facilities for chemical and bacteriological investigation in a few clinics; but the "stagiaire" does not cross the threshold; they belong to the chief, his assistants, the promising intern and the advanced worker from the outside world. Meanwhile, off at the faculty, systematic lectures are given in biochemistry and pathology; but the faculty lectures in biochemistry come in the fourth year and the lectures in pathology in the third—too late by a year or two to be of service to the "stagiaire" who in his first and second year is already dealing with biochemical and pathological phenomena.

I have said that slight differences are to be found. Some of the clinics, for example, omit wholly or partly the introductory lecture course I have mentioned; one of them frankly calls itself propædeutic—undertaking to teach first the little anatomy and physiology that is needed in order to make a simple physical examination. Other clinics exclude the beginner—leaving it to someone else to give him the start he must needs procure somewhere. Again, in the medical clinic of one of the provincial universities, the "stagiaire" does not see the patient until the class assembles. Then the professor assigns two students to two patients, allowing ten minutes for a physical examination. At the end of the period, they report their observations, to which the laboratory chief then adds his findings. At another of the provincial universities, some forty to fifty students are assigned to each clinic. The professor lectures in advance to the whole class, whereupon it subdivides and the assistants conduct small groups of five or six through the wards. Occasionally, as for example in the obstetrical clinic at Paris, well-organized, practical clerking is instituted by a good administrator. Meanwhile, at the school of medicine in the afternoons, systematic lecture courses, didactic and expository in

[13] At Strasbourg, however, as I have already indicated, autopsies are made in the central institute of pathology.

character, present to the student comprehensive surveys of medicine, surgery, and other clinical branches.

In so far as the medical faculty itself is concerned, the French student then learns medicine by attendance on the clinics morning after morning over a series of years, and by attending systematic lectures and practical courses covering first the laboratory subjects, then the clinical branches at the medical school in the afternoons. But, as a matter of fact, faculty instruction that shows thus on the plan of studies is neither the most important nor the really characteristic part of the French student's training. This training is, as I have said, meant to be clinical; the hospital, rather than the faculty as such, is the vital factor. Hence from the outset, the hospital as an organization distinct from the medical school makes itself felt. For the French hospital, with its meager part-time professional staff, utilizes paid non-resident students in their first or second year of study as externs, and paid resident students in their subsequent years as interns. Inasmuch as the medical instruction is intended by the faculty from the start to be clinical in character, it is evident that the student can educate himself best if he becomes part of a hospital organization. From his first day, therefore, he goes into training for the purpose of winning a hospital externship—a three-year appointment—for which most students try during their second year. The faculty does, however, in a measure protect both the student and the hospital: for, before the student can participate in the competition for the "externat," he must have passed his examinations at the faculty in anatomy, histology, physiology, and general pathology, in each of which a routine achievement is thus a prerequisite to the hospital career.[14] Meanwhile quiz classes and practical classes, with which the faculty has nothing to do, though it counts largely upon what they really accomplish, are conducted by interns and assistants in the several clinics for this purpose. In these

[14] A clinical professor comments: *"Il faut surtout passer des examens sans sévérité."*

classes, the student obtains a mechanical drill in anatomy, medical and surgical pathology—these being the subjects in which he is examined. The student body is thereafter sharply divided between those who fail in the extern competition and who, being perforce university students, from now on attend clinics in the mornings and faculty exercises and lectures in the afternoons, and those, who, having obtained a hospital externship, apply themselves for the next two or three years assiduously to their hospital clerkships and to preparation for the next hospital competition, viz., the internship.[15] Once more, however, the faculty interposes; for, before participating in the examinations for the "internat," the student must have passed his faculty examinations in eight additional subjects—physics, chemistry, medicine, obstetrics, bacteriology, pathology, etc.

The test for the internship—limited to those who have previously won the externship—is in some respects severe. It consists of a written examination, which is designed to eliminate those unlikely to succeed, and later of both oral and written examinations, at the close of which the members of the jury rate the performance of the candidates separately, prior to a final conference at which their several ratings are brought together; awards are made on the basis of comparative rank. Inasmuch as the jury consists wholly of clinicians, that which has practical bearing is once more stressed, while the underlying sciences figure merely as tools; inasmuch, further, as neither written nor oral examination contains practical tests of any kind, the outcome depends on the ability of the candidate to set his stock of knowledge in order rapidly and to make a clear written or verbal exhibition of what he has learned from his drill masters and his textbooks. Obviously, an examination at

[15] Externs are free to take the examinations for the internships, as they please, and they may have four trials. Of those who succeed the majority win at the close of the third year of the externship. At Paris, for example, recently, 9 first year externs, 68 second year externs, and 148 third year externs were successful.

this stage must follow a well-trodden path.[16] It must be admitted that the candidates show amazing facility. To this training their subsequent lucidity and fluency are partly due.[17]

The French student body is therefore made up of three strata: (1) the lowest and largest stratum, numbering at Paris several thousand students, who follow clinics for years and by dint of repetition, reading, and a few practical courses acquire the clinical information which will enable them to pass the examinations on which graduation depends; (2) the middle stratum, the externs, whose opportunities, still predominantly clinical, are comparable with, though inferior to, those of the English clerk; (3) the uppermost stratum, the small select group of interns who learn clinical medicine by long continued and intimate contact with patients and teachers. It is from this group that all higher posts in both hospital and faculty are recruited. The opportunities of the interns are in their way unique. They are selected by a competition, which, in its operation and effect, may be compared to the honors system of an English university, for the student, in advance of a regular, guided approach, has to prepare himself to undergo a severe and competitive intellectual test. Once chosen, the intern has opportunities for clinical experience and contacts such as no student in any other country obtains in the course of his medical education. But with all its great opportunities the system is, from several points of view, vulnerable. At the moment when the abler students should be laying a solid scientific foundation, they are distracted by the necessity of getting up minima in several fields. They cannot do in thorough and

[16] It is reported (Journal American Medical Association, Vol. 83, No. 13, p. 1015) that the introduction of a question on a hitherto unused topic at the recent examinations for the *internat* led to violent manifestations of dissatisfaction on the part of the candidates.

[17] Details vary but slightly from place to place. At Paris, which is typical, the written test consists of three questions. The candidate is allowed half an hour for reflection upon each and one hour for writing out his answer. In the oral test he draws from an urn three questions, having ten minutes for reflection, followed by ten minutes for exposition.

leisurely fashion the legitimate tasks of the moment—anatomy, physiology, or chemistry—the very tasks that are for the abler students important; they must have their eye on something else, just beyond. The internship is therefore distracting and premature. Again, the internship is too clinical; for precisely those who should be in no hurry to get into the clinic are the ones submerged in it.

The statistics show not only how the student body is thus split up, but how large a percentage are thrown back on the inferior opportunities to learn, which the faculty of medicine alone has to offer. At Paris, for example, there are upwards of 3,000 medical students, of whom approximately 300, having won internships, get in hospitals the kind of clinical education which the French esteem; 1,000, in which number the future interns are necessarily included, win the externship and thus get a much more limited opportunity to obtain the prized type of training; both these more or less favored groups pay as little attention to the faculty for the time being, as the restrictions above mentioned permit. The remainder, over one half of the student body, pass through the medical curriculum as "stagiaires"—looking on at clinics, attending lectures at the faculty, doing the required practical courses, and ultimately passing the requisite examinations. Other universities are similarly partial in the opportunities offered: thus at Lyons, of an entering class numbering 200, about eighty win externships, of whom fifteen become interns; the rest remain "stagiaires"; a few obtain posts in outside hospitals in Lyons or elsewhere.

No effort is made by the faculty to provide an adequate substitute in the way of training or experience for the large numbers who fail to become externs, or for the still larger numbers who fail to become interns. It does, however, permit them to seek as "stagiaires" instruction in non-university clinics, which, as a matter of fact, do not essentially differ in facilities, staff or activities from the university clinics. An elastic element is thus introduced into the student's clinical training; he is in position to seek advantages; he is made responsible for his own

salvation. The "stagiaire," who has failed to make the "externat," may thus get in some outside clinic as good opportunities as an extern or even intern, but with this difference, that the door of hope (academic or hospital) is closed to him, and with it, the stimulus that comes from the possibility of that type of promotion.

It must from the preceding account be obvious, that, when medical education is viewed as mainly clinical in character, the hospital, not the medical faculty, is the really efficient factor. Not only is the French hospital not controlled by the university, but the hospital as an independent organization actually wrenches educational control from the faculty, and pursues its own way in large disregard of the educational scheme set up by the authorities. It shatters the student body, selecting by *its* examination (not the faculty's) externs and interns to whom it entrusts responsibilities which are so educative in the accepted sense that for the successful the faculty becomes a nominal affair,[18] deriving its importance mainly from its sole control of the degree upon which the right to practise depends. It has been jestingly remarked that externs and interns go to the faculty "only to pay their bills." Certain it is that the abler students pay minimum attention to the faculty—absolving the examinations in the theoretical subjects, not difficult examinations at that, "as a disagreeable task of which one gets rid as quickly as possible, so as not to have to do it again." [19] Clinicians—university and non-university alike—often plan their instruction as if there were no faculty at all. For example, the faculty offers a theoretical course in obstetrics with ten practical lessons. On the ground that "some might have heard the lectures, but not enough to count on," the different staff members of the obstetrical clinic at Paris offer systematic instruction in the anatomy, physiology,

[18] "Many are the students, among the best, who, aside from the practical obligatory exercises and certain formalities, have ignored the faculty altogether." G. Weiss: "L'enseignement de la médecine," etc., in *Bulletin de l'Académie de Médecine*, 3 *série*, No. 15, p. 448.

[19] Letter from a French clinician.

and pathology of the generative organs and the nutrition of the newly born.

Aside from the fact that, as administered, only a small minority obtain the kind of opportunity which the French believe to be educative, one cannot but question the soundness of the conception itself. The premature use of names and remedies stops analysis. The student ought to be trained to observe detailed phenomena; the easy use of technical terms is altogether too apt to insert a barrier between him and the conditions which he must discern.[20] That attendance on the clinics by students who know nothing of anatomy or physiology is wasteful and demoralizing is almost everywhere maintained by laboratory teachers and at times conceded by the clinicians themselves. One is laughingly told that "stagiaire" is derived from "sto," meaning "I stand." "Of course it would be better if they knew something," replied the chief of clinic to a question as to the value of these early years. "I shall," said Professor Sergent in the Inaugural already referred to,[21] "always remember the difficulties that beset the beginnings of my medical studies. Not less intelligent than others, I did not understand the instruction given in the clinics into which I chanced to stray. Names of diseases and symbols of the most strangely mingled kinds bombarded my ears, as the accidental succession of cases dictated: cancer came fast on the heels of pneumonia, rheumatism followed syphilis, the metallic tinkle followed the Cheyne-Stokes rhythm, tuberculosis followed typhoid fever. I could not understand! Why not? Because the instruction was poured out prodigally over a vast field—it lacked method."

[20] *"Das Wissen verdrängt das Sehen."* Wenckebach, *Kunst und Medizin* (Wiener klin. Wochenschrift, April 9, 1923, p. 250).

[21] See note 2, p. 21. Professor Sergent proposes to meet the difficulty by conducting a propædeutic clinic. But (1) this does not go to the root of the difficulty, though it may prove an amelioration; (2) it will benefit only the "stagiaires," who attend Professor Sergent's clinic; all others remain in the same plight as previously. In general, as Billroth long ago remarked, in criticising a similar proposal made by Von Ziemmsen: "a propædeutic clinic is just an additional clinic." (Loc. cit., p. 72.)

The situation is worst in Paris, where the faculty wards are apt to be crowded with students and visitors, to the latter of whom the professor inevitably speaks part of the time. It is in so far better in the provinces where the "stagiaires" are fewer—eight or ten in a medical clinic, with four externs and two interns. But in all alike, the "stagiaires" speak in phrases—a dangerous habit—and go to the wall quickly when pressed. In any case they are rarely asked *to do* anything; at the bedside clinics the memory of what has been recently picked up is mainly in evidence. Even though in course of time, what with repetition, reading, and experience, the student is whipped into shape, it does not follow that he would not have accomplished more and with fewer unnecessary bruises, if a more orderly procedure had been followed. To be sure, brilliant men may be cited in praise or condonation of the methods pursued; but exceptional men are products, not of the French system of medical education, but of freedom. Each in his own way worked out his own salvation—in one case, by way of the Pasteur Institute, in another, by association with a brilliant and painstaking master. I have urged that it is precisely such freedom that the university must not destroy; but freedom enough can be procured in connection with rationally organized opportunity. The fact that men of great natural ability retrace their footsteps, procure special training as the need for it develops, or profit betimes by the counsel of one who has achieved success, is poor comfort to the hundreds whose years are, under the French system, spent on the outer fringe.

IV

The German clinical student is at the outset in a different situation: he has at least spent some two years in endeavoring to acquire a conception of the structure and functioning of the normal body. Presumably there exists in the background of his mind a more or less clear and detailed notion of what the

healthy body is and how healthy organs function, against which the abnormal will stand out in relief.

Thus equipped, he enters the clinics—in what order and for what periods of time we have already ascertained. The clinic, differing radically from both the British and French types, already described, is organized and equipped so as to be adequate not only to the care of patients, but to research and teaching from a modern point of view. It possesses its own laboratories for routine work, for undergraduate teaching, and for chemical and biological investigation; it is in close relation to the pathological institute, where competently made autopsies complete the records of the ward in case of death; it possesses its lecture halls, with the installation needed for effective demonstrative instruction; and it is conducted by a fairly numerous staff, made up of highly trained persons actively coöperating with the chief in each of the three activities to which the clinic is devoted.

I spoke a moment ago of the lecture hall equipped for effective demonstrative teaching. That is the type of instruction which for some three years the student receives. For three years, more or less, the German student spends hours daily following the exposition of a series of clinical masters. In its way, nothing could be better. The cases have been thoroughly prepared for demonstration. Careful histories have been taken by one of the assistants; clinical laboratory examinations made by others; X-ray plates by someone else; cardiograms by still another; this or that therapeutic procedure has been tried and watched; finally from library and museum illustrative material has been marshalled. The professor carries the entire required course. Familiar with the general subject, he makes the patient a text in clinical exposition. Before the student onlookers he day after day goes through the entire process, showing vividly how a scientifically trained and able physician attacks the problem presented by the patient before him. Unity and comprehensiveness of instruction result from the ordered presentation by a single mind—a great achievement, the dis-

tinguishing mark of the most inspiring clinical teachers, French and German. It is assumed that when technique and method are thus vigorously and variously demonstrated in dealing with serious problems, the students will learn how to handle disease, be the problem relatively simple or relatively difficult.

He may indeed learn certain things. He may learn the problematic nature of disease, the infinitely varied and complex data yielded by study, the importance of cultivating an inquisitive attitude, the history of ideas, the value and extent of the literature of the subject. But, as I have pointed out, medicine, be it science or art, concerns the senses; and the senses cannot be trained either to perceive or to function by the demonstrative method. If the student is, as student, to learn how to examine a patient, how to draw an induction, how to conduct an inquiry, how to observe the course of disease whether or not modified by treatment, he must himself participate continuously in the process, not often enough to acquire skill (that comes only with years), but often enough to learn how. The ablest series of expositions by the professor, exhibiting a succession of cases, most of which the student will never see a second time, will not achieve this result. The student may get a passive conception of what scientific study means; but he does not thus himself become an active agent.

By way of furnishing some practical training, two or three devices are employed. Courses are given, usually by the assistants, in physical diagnosis, in clinical microscopy, in bandaging, in obstetrical manipulations, in metabolic diseases, in heart diseases, in pathological anatomy, etc., etc. The material employed is abundant, for the wards and polyclinics are freely used; the assistants are competent instructors and the courses are widely taken.

Whatever practical training the German student gets, he gets mainly in this way. The courses are not, in form, obligatory, perhaps not altogether an objection, since the situation in which he is placed requires the student to use his own

initiative; without them, he would not be admitted to a clinic as "famulus," nor could he pass his examinations. It is, however, a real objection that they are too scrappy. The student learns one thing from one set of patients, another thing from another. But the technique that the professor exhibits—the thorough study of representative problems from every available angle—he never himself carries through in these courses at all. There is small reason to suppose that, having acquired a dozen techniques and viewpoints separately, he is going to put them into effect together after he leaves the university, having never been trained to do it himself there, even though he has seen one master after another perform the feat in the most finished and stimulating fashion, hour after hour, day after day, for several years. Would it not be better to give him fewer demonstrations and more opportunity to practise the entire technique?

In two other ways—one prescribed, the other voluntary—the German student actually comes closer to the patient. Two or three times in the course of a semester he is called into the arena beside the professor to examine a patient whom he has never seen before. An experienced physician might find the ordeal trying; to the inexpert novice it is harrowing. Before a crowded amphitheater, in the presence of the chief and his staff, the "Praktikant"—as he is called—is expected to conduct a physical examination and to reply to questions. The performance is usually brief and fruitless. The "Praktikant" fumbles over the patient, asks him questions that are inaudible to the auditors, replies to the professor feebly, and shortly slinks into the background, looking sufficiently ill at ease, while the professor, forgetting all about him, launches on a luminous, thorough, and admirable discussion.[22]

More helpful is the experience of the "famulus," a volunteer, sometimes during the semester, more often in vacation,

[22] The "Praktikant" of today does not apparently differ from the "Praktikant" as described by Waldeyer, who attended Frerichs' clinic sixty years ago. On the other hand, in Waldeyer's day an informal clerkship was in vogue. (Loc. cit., 106-107.)

in one of the laboratories or clinics. The "famulus" has no definite duties or responsibilities; he makes himself useful as far as he can without becoming a nuisance. Sometimes he is a mere drudge; under more favorable conditions—the staff being more amiable or helpful, or the "famulus" himself more capable—he has access to pathological and other material, assists at autopsies, helps in the clinical laboratory, and even at times breaks into the wards in the train of the staff as they make their rounds, compiling histories and even examining patients, in which work he may get more or less attention from the assistants. Practically every student serves as "famulus" for two or three months in medicine and surgery, and as "Haus-praktikant" in obstetrics.

Thus far, the official training of the student has, however, been almost wholly demonstrative. The Germans themselves are not unaware of this defect. They have sought a remedy in the requirement of a practical year spent in a laboratory or in the wards of an authorized hospital.

The practical year has thus far not altogether satisfied expectations. In the first place, an ineffective method pursued for three years cannot be transformed by belated action of any kind; the method itself should be changed; and would be, were it not deeply rooted in tradition. Again, the German hospital has long been organized and conducted without interns, the main subordinates being assistants serving prolonged periods on small pay because of the unrivalled opportunities enjoyed to obtain experience and to carry on research. If, now, the practical year is to bear definite fruit, duties and opportunities must be redistributed; for only if he became a responsible factor in the conduct of the wards and out-patient department could the young graduate be sure of profiting largely. No such redistribution has taken place. The position of the intern is therefore indefinite and anomalous. Occasionally, the authorities take advantage of his presence to reduce the number of paid assistants or drop them altogether; in such instances, he gets experience, to be sure, but without the super-

vision which he needs. Again, he enters an unchanged organization and gropes about for something definite to do. Not infrequently, he becomes a laboratory helper—a valuable, but one-sided opportunity, not likely to train him either in integration of observation or in practical technique, in both of which his university training has left him deficient.

The fact is that efficient training is neither in Germany nor in France open to all university students; in France the better opportunities are limited to interns—undergraduates selected by examinations, which place emphasis on more or less irrelevant factors—a retentive memory, verbal fluency, self-assurance; in Germany, they are confined to a larger group, already graduated, the assistants, who make their way in the clinic by being useful or by sheer force of ability. The French intern has indeed a splendid opportunity to learn medicine as it is cultivated in France; but the opportunity is premature—the intern is not really ready for it—and confusing, for it disarranges what should be his course of training. The German assistant starts at any rate after he has extracted all he can from his education; and he works in the more stimulating and progressive environment of hospitals well equipped with laboratories, well supplied with literature, and closely contiguous to the fundamental institutes. His range of activities in teaching students, caring for patients, following his chief, coincide fairly well with those of the French intern; but he is better prepared for them. But both French and German systems are, viewed as educational institutions, unfairly partial to the able and fortunate, by whose performance they both habitually judge themselves, as opposed to the English system, which gives every student a "square deal." It will be interesting to inquire, as I shall later, whether the two types of procedure are really irreconcilable.

German critics are not blind to the fact that their system does not produce satisfactory results; but they have not, I think, put their finger on the central defect. Becker [23] and

[23] Loc. cit., pp. 18, 25 ff.

Fischer, already quoted, seek the remedy in reducing the relative prominence of research and in abridging the student's freedom and responsibility. Neither the one step nor the other will help, unless practical training to some extent replaces demonstrative exposition; and if this change were made, it may well turn out that research need not be subordinated, and that the student should retain the freedom consistent with participation in a genuine responsibility. To be sure, in Germany, as in other countries, 95 per cent. of the medical students become practitioners of medicine; but experience in France, England, and America does not confirm the notion that these will be in the long run more skillful or competent practitioners, if their instructors are less keenly interested in problems, or if they themselves have been as students paternally shepherded.

V

Of the other European countries included in the present study, Switzerland does not substantially differ from Germany. The professor is himself the main teacher; his daily lectures, scholarly, well thought out, excellently illustrated, and stimulating, aim to ground the student in the theory and philosophy of medicine. Stress is thus mainly laid upon diagnosis, for the student does not usually see the same case twice. He does not, therefore, in the auditorium see disease at its beginning; on the contrary, as in Germany, he is likely to see only difficult cases in an advanced stage. He does not follow at close range the process of development, watching the change of symptoms and seeking by careful analysis at the bedside and in the laboratory to ascertain precisely what these changes signify; he has no chance to observe day after day the results of treatment; finally, he does not regularly follow to the deadhouse a case long watched and now fatally closed. Practical courses are, to be sure, given by the assistants, utilizing material usually derived from the polyclinic, so that, as in Ger-

many, the student separately acquires the several bits of technique employed in the examination of patients; he serves also as "Praktikant," [24] being called to the professor's side to report his observations on a case assigned to him and to be questioned, sometimes freely and widely; occasionally lecturers add to the vigor and interest of the clinic, by appealing from the "Praktikant" to one or more of the students in the amphitheater. In addition to contact with patients under these conditions, the student has a definite period of attendance in the polyclinic, one month in surgery and three months in medicine; at times, as at Zurich, he makes domiciliary visits, in the company of a competent physician; voluntary service for brief periods, calling to mind the German "famulus," is also in vogue. But the continuous practical and quasi-responsible contact and experience in the wards, by which the admirable demonstrative discourse of the professor might be supplemented, the Swiss student does not obtain, excepting those—an increasing number, it is said—who ultimately become interns or assistants.

The Dutch scheme is peculiar in its total divorce of theoretical clinical instruction from practical experience of whatever kind. The student, having successfully passed his laboratory subjects, enters the clinical division, where he endures two years of unrelieved demonstrative lecturing. Medicine (including pediatrics), surgery, and obstetrics (including gynecology) run through the entire period; the other clinical branches run for shorter periods; there are, besides, lectures in pathology and brief practical courses in pharmaco-dynamics, bacteriology, etc. The student is, of course, surfeited with lecturing—all students apparently, in so far as they attend, hearing the same lectures. Small wonder that complaint is rife that students are passive, and that, up to this point in their training at least, individuality does not disclose itself.

[24] As the students are less numerous, the individual's turn comes oftener: thus, at Bern, the "Praktikant" may be called six or eight times in the course of a semester, instead of two or three, as in the large German universities.

At the conclusion of this prolonged exposure to theory, the student is examined on his knowledge of theory; and only after he has thus won his diploma, does he, as so-called "co-assistant," enter upon a series of ward posts, occupying altogether one and a half years. As "co-assistant," he serves three months in medicine, two and a half months in surgery, six weeks in obstetrics and gynecology, six weeks in psychiatry. During these periods, which fortunately come in no fixed order, the co-assistants rotate at regular intervals through the services, in-patients, out-patients, men, women, etc. Their duties correspond, as far as the formula goes, to those of clerk or intern; but the rotation is so rapid and the hospital organization itself so undeveloped that responsible and thorough participation on the student's part is unlikely. He can, indeed, witness everything that goes on; he is expected, also, to take histories, work up laboratory material, and in obstetrics to participate in deliveries. But the pace is too swift and the organization too scant to meet modern requirements in respect to the study of disease or the training of men.

In the teaching of medicine, the Danish method contains a novel feature, which I have already noted. First year students, known as "volunteers," attend the clinics during the morning hours, rotating through the various services. In the medical clinic, they act as scribes, taking notes dictated by the assistant or intern who chances to be making rounds. No official courses in physical signs are offered; but it is the recognized business of both assistants and students to see to it that the art of physical examination is acquired betimes. At the close of this experience, the student is withdrawn from the clinic, which he does not then reënter until he has, two years later, finished the laboratory subjects. In behalf of this arrangement, it is urged that the student at the outset thus learns how patients are handled, that he picks up useful odds and ends of information and that, finally, he gains some notion in advance as to why he should learn anatomy, physiology, etc.

The last-named point, viz., that a brief preliminary plunge into the clinic sharpens his appetite for the laboratory sciences, I shall shortly consider in another connection. My brief observation did not lead me to attach much importance to the other arguments. The students seemed too passive to be learning practical technique; and it seemed unnecessary, before entering the laboratories, to try to learn to handle patients, when, following the laboratories, they were in one way or another to pass three years with patients. Of these three years, two are devoted by professors and assistants to the instruction of small groups, sitting informally about the bed in which the patient lies. The student has seen the patient in the wards the day before; he has written a case history and carried out the routine laboratory tests. Symptoms, diagnosis, and treatment are thereupon fully discussed. The procedure is reminiscential of the English ward class, with, however, this difference—that, as the exercise is carried on in a room set aside for the purpose, the lesson is more leisurely and discussion more protracted.

In the final year, the continental type of clinic is combined with the group method of instruction—an improvement, in my judgment, upon the daily demonstrative clinic, in vogue in Germany and Switzerland. Twice weekly, the professor holds a general clinic, presenting a patient and in connection therewith exhibiting to the entire class the proper way to approach a patient and to master a problem. On the remaining four days, the students receive in succession a case one hour before the clinic. In the presence of his fellows, the student in charge makes an oral report to professor, who quizzes him roundly on every aspect of the case. Simultaneously, small groups are formed for review of laboratory methods under the various assistants. Finally, following the state examination, as many as two-thirds of the graduates serve an internship—six months in medicine and an equal period in surgery. Thus, in general, the type of instruction native to Denmark may, on the practical side, be described as representing a movement

from the German towards the English view, retaining the professorial clinic, but in combination with bedside instruction of groups by the professor and his aids.

In Sweden alone of the countries of Northern Europe is the clinical student at home in the wards. Having passed his examinations in the pre-clinical sciences, he is instructed in physical diagnosis and clinical laboratory methods. Simultaneously he begins six months' attendance in the medical and surgical clinic and polyclinic, receiving by assignments patients for each of whom he keeps a journal, containing history, "status praesens" and daily observations. Thereupon, for an additional period he concentrates on successive subjects, giving four months more to medicine, an equal period to surgery, presenting himself for examination when in his own opinion he is ready. The length of the period devoted to study enables the Swedish student to simplify his program. Thus, he avoids the miscellaneous surfeiting with lectures to which other nations expose him; but he is also left with more daily leisure than he can—except in rare instances—profitably dispose of. Within each branch, fairly similar lines are followed. The demonstrative clinical lecture, here given three times weekly, exhibits to the entire group the technique and learning of the scholar in medicine. In addition, the chief or an assistant makes daily rounds with a group of students, at this stage called "assistants"—those who have previously spent ten months in the medical clinics, and have also served in various specialties, each member of the group now having charge of seven or eight beds.

The ward teaching does not differ in type from the English, already described. In the polyclinic the same method that is used in England has been independently arrived at, though the clinical laboratory is more freely utilized. The student serves in this fashion eighteen months in medicine, nine months in surgery, three months in pediatrics, four months in obstetrics and gynecology, and equally definite periods in other branches, ultimately returning before graduation, to spend two more

months in the medical, and one in the surgical, wards. The opportunity for practical participation in the care of patients, for reading, conference, study, and even original investigation, is, for the student body as a whole, larger than in any other continental country. The capacious Swedish scheme not only provides practical experience and theoretical training for all, but is roomy and flexible enough to give additional opportunity to the able and industrious. Despite its excessive dispersion, Swedish instruction answers the question I have asked as to whether the best points of German and French medical education can be combined. The Swedish hospital is as well differentiated as the German or Danish; the demonstrative lecture as competently employed as in Germany or Denmark; the student is in as close contact with the patient as in England and has greater familiarity with the laboratory. On the other hand, his years of training exceed those in any other country. Is this the price that must be paid for combining the advantages and peculiarities of several ways of dealing with medical education? American experience, as we shall now see, answers in the negative.

VI

Twelve or thirteen years ago, the clinical teachers of the United States and Canada were, with hardly a dozen exceptions in the entire country, local practitioners in active, general practice. Much of the clinical teaching of that day was didactic, in the form partly of lectures, partly of textbook recitations; to a limited extent, demonstrative instruction—with rare exceptions, far inferior in quality to the continental type—was given; a few schools had introduced the clinical clerkship, and of these, two or three, hardly more, carried on their clinical teaching in hospitals so controlled, organized, and equipped that the student could study his assigned cases continuously under competent supervision at the bedside, in the clinical laboratory, and at autopsy.

Within the period in question, the laboratory movement, al-

ready then in fair swing, has been practically carried to a successful conclusion; the teaching of the laboratory branches has been professionalized. On the clinical side, the outright didactic scandals have been almost altogether eliminated; the facilities for teaching have been widely improved by technical additions to many hospitals—clinical laboratories, X-ray departments, etc.; the hospital's fear of the medical student has tended to disappear as his quality has improved, with the result that ward classes and some form of clerkship are now relatively common; in a few places, the university medical school has obtained complete teaching control under conditions highly favorable to both teaching and research. In general, however, disharmony between the laboratory and clinical branches still exists, though the abyss is neither so wide nor so deep as a decade ago. Occasionally, it is bridged; but for the most part, communication is technical rather than scientific.

The bulk of clinical teaching in America is, therefore, still much below university grade. Thousands of students continue to receive much, sometimes all, of their clinical instruction in scattered hospital services at the hands of busy local physicians, trained under the old régime, who take their students into the wards—an undoubted gain—but under conditions unfavorable to thorough work; for equipment is defective, supervision loose and inadequate, and central control on the part of the school exists on paper only. There are relatively few medical schools in the United States and Canada, part, at least, of whose clinical teaching is not of this slipshod character; and there are not a few whose clinical teaching is of this slipshod character altogether. Not infrequently it happens that the executive officers of the school—the dean and the departmental heads—are themselves uninformed as to the manner in which clinical teaching in some of these so-called "affiliated" hospitals is carried on.

Meanwhile, the not inconsiderable number of hospitals which, having improved their organization and equipment, have entered into exclusive relations of some kind with

a single school, do better by their students; in the best of these the clerkship, if not actually part of the hospital machine, represents at any rate a definite educational gain. The students have free access to the wards; patients—generally fewer than in London—are assigned to them in succession; histories are taken and laboratory tests made, at times more carefully checked and controlled than is common abroad; bedside teaching proceeds much on the lines of the English model. A small number of clinics in medicine and pediatrics, and an occasional clinic in surgery and obstetrics, significant out of all proportion to their actual frequency, aim much higher; to these I shall shortly give particular attention.

As methods, the teacher of clinical medicine employs the systematic didactic lecture, the school catalogue drawing at times a nice and characteristically American distinction between didactic and practical teaching;[25] textbook recitations reminding one of the secondary, if not the elementary, school; the demonstrative clinic playing a secondary rôle, in form like the continental clinic, but in spirit more limited and practical, less philosophic and scholarly; group work in the laboratories, at the bedside and in the out-patient department; finally, the clerkship, varying enormously in quality. The scheme pursued cannot, however, be fairly appreciated if one ignores the internship, of which I shall speak in a moment.

From the method of teaching that prevails everywhere on the continent—official instruction being centralized in the professor—the American method is distinguished by the fact that the important aspects of each main subject are parceled out among the members of a staff, group, or team. A German university catalogue also announces a variety of courses given by the different members of the clinic, as well as by docents, not necessarily connected with the main clinic. But the dis-

[25] For example: "General Principles of Medicine, lectures and clinics (didactic 10 hours, clinic 20 hours); Minor Surgery (didactic 30 hours)." It should perhaps be said that "didactic" may mean a bare discourse without as much as a chart or a blackboard, or it may mean a lecture employing illustrative material—models, charts, drawings, etc.

tinction is an important one; the German professor himself conducts daily the exercises that constitute the official program; other opportunities are separate, private, to be pursued by the student at his own pleasure. The task undertaken by the continental professor is in America officially distributed among a group, the members of which are respectively competent to handle the portions awarded to them; the instruction supposed to be required is all actually arranged for in an orderly fashion. The American student is therefore led step by step into deeper water as he learns to swim. He is carefully grounded in the several steps, theoretically as well as practically; relatively little is left to chance or to his own devising. Thus, no American medical student attends a clinical lecture, becomes member of a ward group, or begins a clerkship without previous instruction in physical diagnosis and clinical microscopy; similar preparation is made betimes for his work in surgery, obstetrics, etc. Practical courses of this kind are, in the best schools, extremely well done. Great care is taken to introduce them at precisely the right moment, and painstaking efforts are expended to procure effective articulation between laboratory and clinical activities. To some extent, the American's overfondness for organization expresses itself in these details; to some extent they are due to considerations of economy. For, as I have shown, American teaching hospitals generally operate with not only too few patients, but with too limited selection in the admission of patients. Careful "housekeeping," so to speak, is thus needed, if the material available is to suffice. The definiteness of the arrangements—the solicitude that the proper preparation be provided at the nick of time, that the student should run no risk of missing anything, that at the same moment whole classes should be examined in order to "score off" their courses—leads foreign observers, not unfairly, to regard even the highest grade of university instruction as "schulmässig." [26]

[26] "Given by school teachers," rather than by professors. The equivalent term in English is "spoon-feeding."

From the standpoint of educational theory, the American scheme contains, though in great qualitative variety, the elements required: the student is sensibly taught the language of clinical medicine before being plunged into the sea of experience; under guidance he then observes the course of disease—its onset, development, response to treatment, and the outcome; some sort of unity is given to these discrete impressions by reading, exposition, and demonstration. On the whole, the spirit of the clinical teaching is too practical, so that the better schools of this group are technical, rather than scientific, in motivation.

There are, however, as I have said, a few clinics in the United States which, despite the obstacles and defects from which in greater or less degree all schools suffer, have undertaken to train medical students in the spirit and method of scientific medicine. Towards this end, they possess, as I have already pointed out, more complete laboratory facilities—chemical, physical, and biological—than are found anywhere else in the world devoted to medical education as such, a relatively numerous and highly differentiated staff, largely, if not wholly freed from the distraction of practice; finally—what is more important—between the subject matter, method, and spirit of the student's instruction and the staff's scientific investigations, it is impossible to draw a line. The student is therefore, in so far as these clinics are concerned, getting his education in close contact with, and to some extent in real participation in, the scientific study and treatment of disease from one or another fundamental point of view. He makes and sees made thorough physical examinations, painstaking records, varied and thoroughgoing laboratory tests, at every stage in the study of the patient; the literature of the subject is utilized; at one and the same time medicine is practised and studied—teachers and students mingling freely and naturally in both activities. Recurring to my efforts to point out the respect in which, in the last decade, the conception of clinical science has advanced, I may say that the teaching units

I am now describing illustrate this development, in that they have effected the fusion of bedside and laboratory procedures alike in the care of patients, in teaching, and in research.

It is obvious that teaching, thus closely intertwined with scientific investigation, must proceed by "sampling." It is neither necessary nor feasible to make the several clinics schematically complete. From the standpoint of research, as I have elsewhere pointed out, no single clinic, no single university can make itself responsible for total achievements: progress is made in the form of steps forward taken in many different places under as many different auspices, integration occurring in infinitely varied ways and under infinitely varied circumstances. From the standpoint of training, fragmentariness, if stimulating and formative, is desirable rather than otherwise, for the medical school, not undertaking to turn out a finished product, but rather to train the student in method and technique, would logically address itself to intensive and thorough study of relatively few patients rather than to extensive contact with many. The student must at one and the same time learn the technique of scientific method, which he can acquire only through "sampling," and he must acquire a vivid sense of the existence of breaks, gaps, and problems. The clinics I am now discussing carry him from the patient in the bed to the point beyond which at the moment neither clinical observation nor laboratory investigation can carry him. There he is left, in possession, it is to be hoped, of an acute realization of the relatively narrow limits of human knowledge and human skill, and of the pressing enigmas yet to be solved by intelligence and patience.

The training which I have now sketched is in the United States almost universally [27] supplemented by the internship. Of 2,452 graduates of the year 1922, 2,265 became interns, in which capacity they become responsible parts of some hospital organization. The interns are, moreover, so numerous in pro-

[27] In Canada, less generally: of the class graduated at Toronto in 1922 (209 in number), 56% became interns; of the class of 1923 (161), 58%.

portion to the number of beds and resident officers, that their work need not be scamped; [28] indeed, it is carried on under close surveillance of senior interns, residents, and the visiting staff. The technical gaps in the training of the American medical student—superficial knowledge of the specialties, lack of deftness in the use of tools—may thus be easily supplied. Indeed, in the light of the experience awaiting the student as intern, the American medical school may with good conscience address itself to the task, not of itself making doctors, but of so training students in method and technique that the internship will provide the larger experience requisite before beginning practice. One must, however, add the obvious comment, that the value of the internship necessarily varies with the quality of the hospital in which it is spent. At this date, American hospitals are still as divergent in merit as American medical schools. Generally speaking, students of better training absorb the internships of the better hospitals. Thus it happens that a poorly trained graduate may be further damaged by an internship served in a poorly organized and poorly conducted hospital.

VII

In order to deal more effectively with the problems I have now described several ingenious suggestions have been latterly put forward. The student has, we have said, the best chance to be trained if he witnesses, performs, or coöperates in doing a few things thoroughly well. The systems of training and examination that prevail, different though they be, are all accused of breaking up the student's training so that, in the end, he learns, and successively forgets, a series of subjects that should be woven into one another. Is it not possible so to contrive that the different threads—anatomical, physiological, chemical, pathological, clinical—will be interwoven as he proceeds?

[28] In a first-rate hospital there may be a resident and four or five interns for a service of 50 beds.

The first of these suggestions proposes to attain this end by regional correlation, under which arrangement the student would take up simultaneously the anatomy, physiology, and pathology of successive regions—head, thorax, etc.; a second proposes correlation by systems, according to which the student would take up simultaneously the anatomy, physiology, etc., of successive systems (respiratory, circulatory, nervous, etc.); and a third proposes correlation on the basis of disease, according to which the student would after a year's work in anatomy and physiology take up one important disease after another—anatomist, physiologist, pathologist, bacteriologist, and clinician, coöperating in the demonstration and exposition of each.[29] Thus, in one way or another, the curriculum would be composed of a series of stories—problems or years—each story of the edifice as built, fitted out with its appropriate anatomy, physiology, biochemistry, bacteriology, pathology, clinical medicine, or surgery.

The objections are several: in the first instance, such reorganization would involve an enormous increase in administrative complexity. The American medical school is already over-complicated and over-administered. Complexity would be seriously aggravated, if, whether by the action of the dean or through the voluntary coöperation of departments, enterprises of this kind had to be generally devised and carried out. Let us suppose that they undertake to deal with selected problems, regions or systems involving the heart, the kidneys, the stomach, the lungs, the central nervous system—is it not clear that the administrative burden will be greatly increased at the cost of the pitiful fragments of time and energy now left to the staff for research and reading? The Bulgarian General Savoff was right: "One can organize too much!"[30]

From the standpoint of the teacher, there is another objec-

[29] The advocates of correlation seem to be under the impression that the project is novel. It was, as a matter of fact, dreamed of by an impractical Austrian emperor as far back as 1786. (See Billroth, loc. cit., pp. 132, etc.)

[30] Quoted by Noel Buxton: *With the Bulgarian Staff* (Macmillan, 1913), p. 146.

tion. If "integration" or "coördination" is thus to be avowedly pursued, teachers must be selected with some regard to their capacity for this kind of team play. The laboratory branches may thus lose something of the independence absolutely requisite to their development; they may tend to become medical sciences, rather than sciences, thus exaggerating the dangers involved in inclusion in the medical faculty.[31] It is not easy to obtain pathologists, physiologists, chemists, and internists, who can administer a department, teach students, and carry on research; it will assuredly make the task of selection more difficult and tend to throw out strong personalities, if one must also require that the university professor be interested in a particular type of undergraduate team teaching. If one rapidly recalls the men who in Germany and America have most deeply stimulated medical education, one will perhaps be surprised to find how individual was their line of approach, and how reluctant many of them would have been to engage on a large scale in organized correlation; and this is, not surprisingly, true of some of the most amiable, coöperative, and adaptable among them. The intimacy of the relationship thus sought would exaggerate the value of team or club characteristics (by no means an imaginary danger) at the expense of the more assertive qualities not infrequently marking the ablest teacher, investigator, or colleague; curiously enough, too, the working relations that strong independent men develop on the basis of mutual respect for unusual ability and achievement may, in the end, prove more effective than the neat dovetailing, more readily brought about between less positive characters, or between men cast in the same mould—social or educational. To be sure, coöperation and contacts are important: it is for this reason that I have urged unification within the university—administrative, social, and local. But the proposed type of integration or correlation would be more disastrous than excessive autonomy.

[31] In this event where would their aspects, other than medical aspects, be cultivated?

Carried further than mere illustration of what thorough study of a clinical problem requires, correlation may even harm the student whom it is intended to help. True enough, there is a lack of immediate connection between his several studies of the anatomy, physiology, and pathology of the heart. But let us not forget that these branches possess respectively a unity of their own, viz., that of their several subjects. For the student of anatomy cannot simultaneously study the heart from the successive points of view of anatomy, physiology, pathology, and clinical medicine, and the heart from the standpoint of its place and function in the body's architecture. When, having studied the heart from architectural and functional points of view, he comes subsequently upon the pathological or the clinical problem, he must, to be sure, delve back into his memory and experience, and make a synthesis from a different standpoint. There is, I repeat, no objection to illustrating for him how this is done; but the already overcoached and over-taught American medical student will find the educative burden left for his own efforts enormously reduced, if an entire program is thus arranged for him. That he will have forgotten many things is, of course, obvious; that he must recall, review, extend his reading, equally clear. But in no other way can he possibly learn. Not the most ingenious dovetailing and correlation that can be devised will—or should, if it could [32]—save him from the necessity of making just such efforts throughout his professional life. *"Repetitio est mater studiorum"*: sheer repetition, in one form or another, now accidental, now intentional, unprovided for, but inevitable and constantly recurring in different connections—thus only does one learn. The solution lies with his successive instructors; their mastery, standards, ideals, and stimulus must compel the student to review forgotten data, to ascertain fresh facts and to bring them together; and the more the student is thus forced to return to his authorities, to survey various kinds of knowledge that he resuscitates for himself from the new angle of

[32] An old saying is relevant: "No knowledge without tears."

the clinic, and, best of all, to acquire fresh knowledge, the better for him. A good teacher of physiology, a sound teacher of medicine or surgery, would spurn the mechanical correlations of a set curriculum; each of them would, however "correlate," "associate," "recall" at every breath—and, best of all, stimulate to further inquiry, reading, or investigation on the student's part; but no two would perform the trick in the same way, as is the assumption and purpose of those who work out plans of correlation meant to guide the instructor and to shepherd the student.

In principle, the same objection may be made to the recent action of the General Medical Council inserting in the study of medicine "a course of applied physiology" and in surgery "a course of applied anatomy." Sir George Newman very soundly holds that "chemistry and physics, anatomy and physiology, pathology and pharmacology must be brought into the clinical sphere"[33] but surely through clinicians trained in the medical sciences teaching and working under university conditions, not by means of "reviews" superimposed upon old-fashioned bedside teaching.[34] In all these half-remedies, too much mechanism is involved; too much is done for the student, too little by him. The human mind cannot thus be insinuatingly led into education. On the contrary, reasonable opportunities being offered and high standards of performance prevailing, the mind has to educate itself. With all its faults, university education in Europe is on this point sound, for it expects the student to "learn," while in America far too commonly he expects only "to be taught."

[33] *Recent Advances in Medical Education in England* (London, 1923), p. 90.

[34] "What gave Schönlein his great advantage," writes Billroth, "was his extraordinary encyclopedic knowledge of the natural sciences, his complete command of the physiology taught in his day. He had it all at his finger tips, so that his students constantly traveled with him down the broad streams of science, physiology, and practical medicine, blending theory and practice into one. At every moment they experienced the joy of seeing what they had already learned practically demonstrated and confirmed at the bedside." (Loc. cit., p. 229.)

VIII

One hears with increasing frequency nowadays in the United States another dubious suggestion. The medical student—a university student, already of mature years, be it remembered, studying anatomy, physiology, and biochemistry, "does not see the use of it"; he is depicted as therefore lacking in interest and energy. Had he enjoyed an early brush with the clinic, he would realize why he must know anatomy and physiology; and his eyes thus opened, he would plunge into the study of the underlying sciences because he knows that such efforts will pay.[35] Apparently, for some such reasons, the Danes, as I have pointed out, require the beginning student to attend the medical clinic as "stagiaire" for a semester, after which he drops out of the clinic, not to return until he has absolved the laboratory subjects.[36]

Now, of course, a pedantic attitude, excluding from the fundamental laboratories all reference to the clinic as though it were contaminating would be absurd. A physiologist may just as legitimately make a point by exhibiting a patient as by experimenting on an animal; but it is the lesion and its pathological results, not the disease and its therapeutics that are at

[35] In a pamphlet issued by the University of Pennsylvania the following statement is made: "Once a week, the first-year class in medicine receives a clinical lecture in the amphitheater at which one or more patients are demonstrated. The subjects presented are correlated as closely as possible with topics being covered in anatomy, physiological chemistry, and, later, physiology. These hours illustrate to the students that the fundamental branches have practical applications in medicine and are daily employed in diagnosis and treatment. It is hoped in this way to stimulate the student's interest in the intelligent study of the fundamental branches and to make it clear to the student from the very start that everything which he is studying is actually fitting him to practise medicine." A similar procedure is followed in surgery on the ground that "not only will it enliven the student's interest in laboratory exercises, but, realizing their practical importance, he will apply himself with greater zeal and be more likely to remember what he is being taught at the time."

[36] Recently Hellpach has suggested that Germany introduce something similar: *Die Neugestaltung des medizinischen Unterrichts* (Berlin, 1919), pp. 70, etc.

that moment proper objects of interest. A mixture of the two standpoints, if deliberately and systematically undertaken for the purpose of buying the student's attention, ought to be unnecessary and is surely unsound. If it aims to engage the student's interest by demonstrating to him the value of knowledge of anatomy and physiology, it surely underrates his maturity and his seriousness.

In so far as the early introduction of clinical demonstration seeks to fasten facts, by associating them with their use, it deals with so inconsiderable a body of details that it is bound to be futile; and the effort may be, indeed, rather worse than futile, for, while the student is getting a firmer grip on a few associated anatomical, physiological, and clinical facts, the infinitely larger mass of anatomical and physiological data, for which no clinical support is furnished, may all the more readily and entirely drop out of memory. To the same end it has been seriously suggested to a university faculty that surgeon, physician, and neurologist should agree with anatomist and physiologist upon the set of facts or principles which the clinical group will rely upon the scientific group to inculcate—the assumptions being that there are certain facts or principles which can thus be singled out, that students to whom they have once been taught will "know" them, when they come later to study medicine, surgery, or neurology, and that thus there will be no lacunæ to be filled in, no re-learning to be carried through.

As a matter of fact, however, the notion that recalling or renewing facts and principles once learned is a waste of time, or can by any device whatsoever be eliminated, is a mistaken one. Things of importance are not learned once for all; they are, as I have already urged, learned by being repeatedly recalled and in all sorts of ways. Finally, the whole forward movement in medicine has come from the substitution of different types of bond at different stages for the simple clinical bond, still preserved in France. It is absurd to say that in the study of anatomy or physiology bonds are lacking, which must be supplied by premature introduction of clinical ma-

terial. Anatomy has within itself sufficient cohesive and associative power; so has physiology, and the two naturally reinforce each other. The student, if properly represented as painfully acquiring and carrying a load of detached anatomical or physiological data, has been tragically mistaught, the remedy for which is a different teacher of anatomy or physiology, not recourse to an unsound method. The sciences in question are fascinating pursuits, organically complete as such, progressively recalling and supporting one another—and would be properly so described, if there were no such things as medicine and surgery at all.

To all these devices there is the same objection, viz., that they seek to accomplish by manipulation and machinery what can be achieved only by effort, mainly the student's own effort. We have made it harder to achieve than need be by overloading the curriculum. The remedy is to do less for the student rather than to do more for him. But when the curriculum has been simplified, defects and disappointments will not disappear; these, due largely to human frailty, cannot be exorcised by jugglery. Far more wholesome would it be to admit once for all the *difficulty* of *learning* medicine, and the *impossibility* of *teaching* it.

IX

However the teacher teaches, the way in which the student studies is largely influenced by the examinations.[37] In Europe, oral, written, and practical examinations are everywhere employed. The oral examination tests the candidate's readiness; but no preparation can be so skillful as to outwit an intelligent examiner, quick to detect whether the candidate has really grasped a subject or is merely skating over thin ice. The written examination is a fairer method of testing the candidate's resources, for it allows time for cool reflection. Finally, the practical examination ascertains the relation between the words

[37] For the details the reader is referred to the Carnegie Bulletin, No. VI. The various systems remain as there described.

the candidate uses, the objects he knows, and the things he can do.

Any sort of examination can be to some extent eluded by expert coaching; a combination of the three types reduces the candidate's chances of imposing on his examiners. Nevertheless, coaching everywhere wins promotion and graduation for those who deserve neither.

One merit, however, can be claimed for all European examinations, viz., they deal with subjects as wholes, and the examiner, facing his candidate, is free to make an incursion into any field. By way of distinction, the American examinations, almost wholly written, adhere closely to the course and year organization of the American curriculum; courses run half a year, and, regularly, at appointed dates, the entire class must undergo a test in each of them. Thus the student is held responsible for some sort of mastery, not of a large subject whole, but of a mere fragment—and that, too, in each of the subjects which he pursues. The examinations thus do what they can to defeat correlation and to prevent comprehensive grasp. It seems clear that, when the fixed curriculum has been broken up, the definite examination schedule must be abolished, too. Course and term examinations deflect the student's attention to a false end. Far better to submit the student to brief examinations—oral, written, and practical—in large fields, and to allow him to arrange for them with the chiefs of the several divisions at their mutual convenience. To eliminate the idler, who has proved a nuisance in Germany, the professor may reserve the privilege of summoning for examination the student who betrays an excessive disinclination to give an account of himself.

Let me, however, in conclusion emphasize one point. Examinations are necessary; there is no way of getting on without them. But their importance, even as a protection to the public, may be over-emphasized; for the moment too much is made of them, the good teacher is hampered and the student is forced into the arms of the expert "coach." Thus the ex-

cessively practical examination of the Conjoint Board in England is an obstacle to scientific training; and the meticulous detail of the American State Board examination, instead of stimulating good work, puts a premium upon dead detail. Too rigid examining therefore defeats its own ends. In the long run, systems of education stand or fall by virtue of effort and ideas, not machinery. From this study of comparative education in medicine over a wide range of peoples, this is the outstanding lesson to be learned.

X

I have throughout this volume emphasized the view that the medical faculty, belonging, as it does or should, to the university, is equally concerned with teaching and research. The university faculty of law trains lawyers and should carry on investigations in the field of jurisprudence; the university faculty of theology trains teachers and preachers and should carry on investigations in the field of ethics, church history, and New Testament Greek; so the university faculty of medicine trains physicians, and carries on investigations in anatomy, physiology, and other sciences. A so-called faculty—medical or other—is thus necessarily more than its name implies. It must inevitably be so. Medicine changes with startling rapidity; the student cannot be trained abreast of the times, still less launched on his professional practice as an actual learner or contributor, unless he studies under teachers who are active workers. The waters soon become stagnant unless continuously fed by fresh springs. Moreover, no country is rich enough to equip schools of medicine in the elaborate fashion that sound teaching requires, and then reproduce the outfit, more or less extended, for research purposes.

On the other hand, the medical faculty may not forget its practical responsibility for the training of physicians. The two functions do not entirely coincide; for research is intensive and specialized, while teaching is in part general, not to say

elementary. There is, at first blush, therefore, a certain plausibility in the notion that, though teaching and investigation must be carried on in the same institution, they are more or less antagonistic, because they encroach on a common fund of time and energy. At a given moment or for a particular individual, any differing types of activity, interest, or duty may indeed obstruct one another. But, in general and in the long run, teaching and research assist rather than hamper each other, if for no other reason than that the fund of time and energy is capable of being increased by the interest which research adds to what would otherwise become routine. But there are additional reasons for holding to the university conception. Few men are so fertile in ideas that they can profitably devote their entire time to research; the others, a vast majority, do better if their tasks are varied, if there is a certain competition and mutual suggestiveness among research, teaching, administration, and even one's personal affairs. Fortunately, one does not in this matter argue without the light of experience. During the last century the great German investigators were almost invariably university professors; and, as a general rule, the most original have shone brilliantly as teachers. In any case, the man, and especially the young man, who wants to work will find a way; and finding the way is by no means a total loss. The problem is, to be sure, not free from difficulty, nor can it be solved by a formula. A given individual may incline too far to one side or the other. But the welfare of science and the welfare of the student are alike most effectively safeguarded if facilities and indeed departments are constituted of men of different types, supplementing, stimulating, or even in some instances ignoring one another, and if students are, as in pre-war Germany, free to migrate in search of the opportunities and contacts most likely to help them.

CHAPTER XI

INSTITUTES FOR MEDICAL RESEARCH

I

Though medical education is the subject of this volume, I have tried to show throughout the impracticability of drawing a line between medical education and medical research. In the German universities, teaching and investigation have long been regarded as equal factors in the conception of higher education; in Great Britain, France, and America, universities were until recently as institutions mainly concerned with teaching, research being regarded as an incidental or individual affair. But modern developments in medicine, as in other fields, have resulted in a general acceptance of the principle that efficient and progressive training is procurable only where original scientific activity is in progress.

Meanwhile, long before universities became alive to the principle just stated, special arrangements, which I shall briefly mention, were made to promote research and to establish contacts between persons interested in scientific progress. Latterly, institutes have been founded in order to expedite research in the field of medicine, as in other fields. The creation of such institutes does not relieve the university of its research function; for if it be true that higher teaching cannot be efficiently prosecuted except in the atmosphere of scientific inquiry, then the existence of research institutes does not alter the educational situation. Nay more, even from the standpoint of scientific progress, the medical faculty does not shrink in importance; for the facilities of the university are too expensive to be often duplicated in institutions devoted solely to research, and the university possesses in the variety and extent of its collateral

facilities resources which research institutes, being specific in purpose, are not likely to possess. The medical faculty continues, then, to be charged with responsibility to advance, as well as to disseminate and apply, medical science. Has the institute for medical research any definite educational function? Does the present chapter belong in a book devoted to medical education? The founders of institutes of research were assuredly thinking of investigation, not education. A brief survey of the evolution of research will, however, show that in these days research can no more be divorced from medical education than can medical education be divorced from research.

II

In the early stages of scientific development, research was stimulated through learned societies, for the universities were in that day still expounding in Latin traditional lore. Some of these societies were patronized by the governments of their respective countries; others were private organizations. In the first instance, they were merely groups of persons with common interests, who, working each as best he could, came together to report to one another and to discuss results and propositions; gradually they began to issue publications in the form of bulletins or transactions. In course of time, they obtained, now from government, now through gift or bequest, funds with which particular individuals could be supported or particular inquiries subsidized. Of this type is the Royal Society, the origins of which antedate the Restoration, though official recognition was first obtained in 1662. For three hundred years, the Royal Society has been the recognized authority to which the British Government has appealed for counsel in problems and undertakings involving scientific knowledge; latterly, at the request of the government, the Society has managed investigations dealing with tropical diseases, malaria, sleeping sickness, etc. The French Academy of Science, originally projected by Leibnitz in 1700, but reor-

ganized in its present form in 1816 as a branch of the Institute of France, devotes one of six divisions to the sciences which touch the field of medicine, namely, chemistry, physics, and biology. In the United States, the National Academy of Science was organized during the Civil War in order to advise the national government. Similar organizations, more or less closely connected with government, exist in other countries. Side by side, voluntary institutions, endeavoring to encourage research, have sprung up. The most distinguished of these, the Royal Institution, will be forever memorable because of the professorships in natural philosophy filled by Thomas Young, Davy, and Faraday.

Academies and learned societies have become more, rather than less, important as means of bringing together workers in allied fields and in different countries; but the relative importance and effectiveness of their subventions to research have decreased, as universities have taken up research activities, as research institutes have been set up, and as research has itself become so complicated that subvention for a limited period or a limited object provides neither the facilities nor the assurance requisite to elaborate and protracted endeavor.

On the other hand, something of value always falls outside the sphere or the possibilities of organized institutions. An important function may therefore still be discharged by mobile funds. Hence the steps which resulted in the creation of the Medical Research Council in Great Britain were soundly taken; for this central fund is now utilized to support research workers in universities, hospitals, and kindred institutions throughout Great Britain and to a less extent in other parts of the Empire, in the hope of not only increasing knowledge, but of training a larger group of men and women capable of modernizing the medical faculties of the British universities. The fund—in itself modest enough—has been wisely utilized to take advantage of existing facilities: the grant made by the Council supports the selected worker, perhaps also supplies something unusual in the way of apparatus or service. But in general

the Council has employed existing facilities, meanwhile using its influence effectually to procure benefactions that provide the necessary material basis.[1] To the same general purpose, other funds variously created and controlled operate: in the United States, for example, the Carnegie Institution of Washington, the American Medical Association, and the National Research Council; abroad, the Beit Fellowship Fund (Great Britain), the Carlsberg Fund (Copenhagen), and, in effect, the Nobel Prize Fund, which, while recognizing performance, makes possible further achievement.

Special professorships devoted to research have also been employed. Thus the German government has occasionally rewarded a brilliant scientist, as it attracted Van't Hoff by providing him with research facilities and freeing him from all teaching duties. In 1910, the University of Pennsylvania obtained an endowment for the support of a chair of research medicine. Quite recently, the Fullerton bequest has enabled the Royal Society to create a research professorship of physiology for Starling at University College, London. The research professor has no regular teaching duties; but he is still an educational factor, for not only may he stimulate a faculty by keeping up a high level of productivity within the university, but he is necessarily in contact with the advanced students and research workers, by whom in course of time regular university posts will be filled. A possible source of danger may also be pointed out, for in countries in which universities are still largely on the teaching plane the research professorship may be regarded as a device which relieves the rest of the faculty of responsibility for scientific activity.

I have now briefly mentioned various agencies which have been set up in the course of the centuries for the cultivation or encouragement of scientific research—academies, under governmental patronage, learned and professional societies formed by interested individuals, special endowment funds, the trustees of which distribute income in the form of subventions, finally,

[1] See p. 170, note 7.

research professorships, occupied by individuals who enjoy the advantages of university associations, while freed from ordinary university routine. The final stage in the evolution which I have sketched is the outright institute for medical research, established for the express purpose of expediting the increase of knowledge. Discoveries in the field of bacteriology, immunology, chemistry, and physics, taking place within quick succession, suddenly opened new vistas. Infection and contagion have been the main enemies of human kind; their conquest was unexpectedly brought within range of possibility. The men existed; why divert their unique talents into teaching, why hamper them with limited facilities? The research institute in medicine was designed to furnish competent productive workers with the conditions needed for investigation, free from academic tradition and academic responsibility. We shall see that certain of them, for one reason or another, also undertook to make new knowledge practically effective; but in the main investigation may be regarded as the actual purpose in the minds of the founders.

On the other hand, the personal factor also played a part in the establishment of the early research institutes. The general situation was such as I have indicated; but sheer scientific possibilities did not alone suffice to procure facilities for medical research. The first institute of medical research crystallized about an appealing personality and a touching incident. Pasteur, as I have already had occasion to note, spent no mean part of his most productive years vainly seeking facilities and support. His fundamental contributions to science and industry had long since securely established his fame, but to no avail, when the healing of a little Alsatian boy, bitten by a mad dog, touched the sympathy of the world, and led in 1885 to the popular subscription which founded an institution to be devoted to the preventive treatment of hydrophobia. The sum of 2,500,000 francs was raised, of which 1,000,000 francs were to be set aside as endowment; the income was to be increased by the sale of vaccines. Broken in health, Pasteur thus dramatically

procured a few years before his death the institute of which, in his mind, the main functions were to be investigation and the training of investigators. Its laboratories were devoted to bacteriology, biochemistry, the prevention of rabies, and the production of vaccines; subsequently a hospital was added; recently, the scope of the institute has been extended through coöperation with the University of Paris by the addition of the Radium Institute, the physical-chemical division of which is headed by Mme. Curie, the biological division by Regaud. The inadequate funds available for research in the field of radio-activity have, however, to be supplemented by earnings derived from clinical work.

Hardly less personal were the considerations which led to the establishment of the Institute for Infectious Diseases at Berlin. While serving as district physician, Robert Koch had made important contributions to the knowledge of splenic fever and wound infection. Called to the Imperial Health Office in 1880, he rapidly devised new methods of bacteriological investigation, discovering first the bacillus of tuberculosis and in quick succession the spiral of cholera. The little laboratory in the health office was plainly inadequate to the genius of Robert Koch; with characteristic farsightedness, the state in 1891 established for Koch an institute, consisting of laboratories and hospital, primarily for research in the field of infectious disease and the basic sciences; secondarily, for the guidance of the administrative departments and for the prevention of hydrophobia.

Still another path has led to the research institute. The German university cultivates research; but the investigator is also a teacher and an administrator; he has contacts with students, with colleagues, with officials, with the general public. Men like Helmholtz prosper in this throbbing environment; every form of activity stimulates them to thinking and doing. Loeb, on the other hand, brilliant in a university chair, attained maximum effectiveness in a more sheltered situation. Ehrlich was plainly ill adapted to academic routine—he made,

like Pierre Curie, a "poor candidate" [2] for university preferment. A modest provision was first separately made for him at Steglitz. But a wise administrator, bent upon making the most of him, shortly found a pretext for creating for him the Institute of Experimental Therapy at Frankfort, devoted to the investigation of biological and chemo-therapeutical problems. Moreover, considerations of the same kind apply to foreigners: a different past and a new language interfere with their transfer to appropriate academic posts; but neither past nor language was an obstacle to the transplanting of Metchnikoff to the Pasteur Institute, or of Carrel, Noguchi, and Landsteiner to the Rockefeller Institute.

Other research institutes have originated in ideas or in the desire to develop certain fields, rather than in the desire to provide adequate facilities for a particular person. The Lister Institute, for example, undertook to reproduce the Pasteur Institute on British soil; it contains divisions for research in bacteriology, proto-zoölogy, physical-chemical problems, and facilities for the production of vaccines and sera on a large scale. So, more broadly conceived and more largely endowed, the Rockefeller Institute for Medical Research was established in 1901 for the purpose of research in any field that gave promise of a return in medicine; on the laboratory side it now includes pathology, bacteriology, chemistry, biophysics, general physiology, and experimental surgery; the hospital of the institute is a highly developed research hospital, with separate divisions, each with appropriate laboratories, engaged at the present time in the study of certain selected infectious diseases, cardiac diseases, and metabolic problems; a third department is devoted to the study of the comparative pathology of animal life. The state serological institute at Copenhagen, established on an independent basis in 1902, is at once a practical laboratory for all Denmark and an active center of research in bacteriology and immunology. Again, shortly before the outbreak of the war, the Kaiser Wil-

[2] *Life of Pierre Curie* by Marie Curie (New York, 1923), p. 148.

helm Society founded at Dahlem, a suburb of Berlin, splendid laboratories for research in experimental therapy, biological chemistry, and other subjects. Finally, in addition to its distribution of subventions to workers in hospitals and kindred institutions, the Medical Research Council has set up a laboratory at Hampstead for research in the fields of biochemistry, pharmacology, applied physiology, experimental pathology, and statistics. Special institutes and laboratories for the investigation of single fields or subjects—infectious diseases, cancer, tuberculosis, the brain, etc.—have been created in Chicago, Boston, New York, Philadelphia, Amsterdam, London, Paris, and other places—some of them independent of, some of them affiliated with, universities, some associated with hospitals, and still others with state or municipal health agencies.[3]

Though the institutions and laboratories above-named are all known as research institutes, it is clear from their history that they differ widely in scope. Some were built about a person or an idea, and tend to keep to a limited field; others, while primarily founded to increase knowledge, undertook also to make the newer knowledge effective through the manufacture and distribution of sera and drugs; few of them are so liberally supplied with funds that they are independent of income derived from their own labors. Meanwhile, research institutes, like medical faculties, cannot remain simple; however limited or specific in appearance the original purpose—research in bacteriology, research in cancer, research in the properties of radium—the quest for truth lures the worker into unexpected directions: other laboratories—chemical, physical, biological—become essential; larger support, more highly trained personnel become necessary. At this point research institutions have an obvious advantage as compared with medical schools. There are certain fundamental subjects of general importance which

[3] I have not endeavored to include in the above sketch medical research institutes in countries lying outside the scope of my survey (e.g., Russia, Japan, etc.); nor have I included the research laboratories in industry, some of which have been active in investigation.

all medical schools must cultivate up to a certain point, however differently they develop thereafter. The research institute can, however, retain an opportunistic character, pushing further only if proper leadership is available and tempting clues have been disclosed. In the absence of a person and an idea, it may at any moment discontinue one line of work in order to explore elsewhere. The particular subjects pursued thus shift, partly as personnel changes, partly as workers, finding their path blocked, either modify their mode of attack or select new problems. Workers who do not take kindly or fruitfully to these conditions drop out, so that the "turnover" in an active research institution is likely to be larger than in a faculty of medicine. Again, the research institute, free of the necessity of training young men for professional careers, may approach problems more speculatively, more intellectually than faculties responsible for teaching as well as for research. The research institute may thus be more flexible, perhaps more fundamental, than the medical faculty. But, on the other hand, the mobility and definiteness of the research institute involve a corresponding disadvantage. The university investigator is in easy reach of competent workers in many fields—physics, chemistry, biology, mathematics. He is in position to procure readily such specialized coöperation as he may require. The research institute, intensively developing a few chosen lines, is hardly likely to possess the range of talent that at any moment thorough work may require. If resources are abundant and scope broadly defined, gaps may be filled as they appear; men may be detached for further or special training, or special workers may be procured, as needed. In the absence of large resources, serious limitations may, however, make themselves felt. But the intricacy of the medical problems now under attack raises a serious doubt as to the future of research institutes, which are either inadequately financed or narrowly limited in field and personnel.

III

Research institutes appear thus both as agencies for the investigation of medical problems and as agencies to assist in making practical use of recently acquired scientific knowledge and technical skill. As neither do they necessarily figure in a volume concerned with medical education. But, as a matter of fact, research institutes are also in the best sense teaching organizations and, as such, come within the scope of the present study. They have, indeed, more in common with medical faculties than appears on the surface.

In the first place, both organizations advance knowledge. Between the problems under investigation in the laboratories and clinics of a medical faculty, and those under investigation in the laboratories and clinics of the research institute, there is no necessary difference in quality, difficulty, or importance. The solution may come, indifferently, from one or the other. Salvarsan emanated from a research laboratory, insulin from a university laboratory; an anti-pneumococcus serum from a research clinic, an anti-scarlet fever serum from a university clinic.

Again, the research institute discharges teaching functions, sometimes directly, more often, indirectly. At the Pasteur Institute and the Koch Institute regular courses are given for the benefit of students; more frequently, special courses are arranged for physicians in practice, for health officers, and for teachers. But over and above these obvious teaching activities, the research institute, like the university faculty, trains men, and, as an institution in which men are trained, influences, and makes its main contribution to, medical education as such. The regular activities of the research institute, like the staff activities of the university faculty, annually absorb groups of recent graduates, who engage in research and thus prolong and improve their own training. A few remain permanently in research; most of them go out into practice or into teaching posts. Thus in the most important sense of the term, the re-

search institute and the university faculty are both training centers. The research institutes were originally recruited from schools and universities: Pasteur, Martin, Roentgen, Loeffler had all been teachers. Soon the research institutes began to repay the debt: the Pasteur Institute has assisted in the training of scores of teachers of medicine for France, Germany, Great Britain, the countries of Eastern Europe and South America; Landouzy, Chantemesse, Widal, Brumpt, Bordet, are a few selected at random from the long roll of those who for varying periods have been numbered among its workers. The Lister Institute has similarly participated in the training of professors and laboratory directors throughout the British Empire. In respect to problems and personnel, German faculties of medicine and research institutions are hardly to be distinguished; separate in organization and control, they have functioned as one in the promotion of scientific medicine. Physicians, health officers and teachers of medicine, present and prospective, native and foreign, have enjoyed the hospitality of Professor Madsen's Serological Institute at Copenhagen. The laboratories and hospital of the Rockefeller Institute are already represented on the medical faculties of Columbia, Yale, Johns Hopkins, Harvard, Chicago, Pennsylvania, Vanderbilt, and other universities in the United States, and similarly in the universities of London, Copenhagen, Leiden, and other foreign centers. Thus an active interchange between medical schools and research institutes is in progress. Workers transfer now from universities to research institutes, now in the opposite direction. Problems, points of views, knowledge, personnel thus move to and fro. Medical thought, medical education, medical practice benefit from this unimpeded circulation of ideas. The institute for medical research is not therefore to be regarded as something fundamentally different from the university faculty of medicine; it is a partial faculty, happily circumstanced, freed from undergraduate teaching, but, like the university medical faculty, a coöperative group of workers devoted to training as well as to investigation. In no country can at this date

a sharp line be drawn between them. Fortunately, too, a line cannot be drawn between different countries. Students of medicine of all nations are at work, wherever they have something to learn; and inevitably in learning, they teach. Differences of language count for less in the research institutes than anywhere else; workers and teachers from every corner of the compass are thus brought into close and stimulating contact; education and research both profit. Over and above this immediate result, it is something to possess in every country institutions in which earnest men of all races and nations coöperate for ends that obliterate national lines.

CHAPTER XII

COSTS

A—FIFTEEN YEARS AGO

I

Fifteen years ago medical education was supported with reasonable adequacy only in the Germanic countries of Northern Europe, and especially in the German and Austro-Hungarian Empires. In the matter of support at that time a few facts stand out: the universities of the countries just named enjoyed without financial burden to themselves the unrestricted use of abundant clinical material. Hospitals of recent construction had been purposely built by the state or local communities so as to answer teaching purposes, and older buildings had been intelligently adapted to the same use. For these unrivalled opportunities to teach and to investigate, the universities were financially responsible only to the extent of the relatively trivial supplementary cost of such assistants, such apparatus, and such supplies as a well conducted modern hospital would not itself require in order merely to care for patients and to carry on a varying amount of scientific work. Hospital cost was not, of course, thus eliminated, but it was shifted from the university to the community and to industry, where it properly belongs.

A second fact was notable. The sums provided for medical education by the countries in question were far in excess of the sums elsewhere available.[1] But the official figures understated the cost. In the first place, the income of the professor

[1] The figures available in 1912 are given in Bulletin VI, Carnegie Foundation, Chapter XII.

himself consisted of a salary paid by the state [2] and of fees, from students, examinations, etc. The income of the professor even in the smaller universities was thus considerably above the official salary that appeared in the budget. In the large universities, where, on the clinical side, the student had in medicine and surgery at least a choice among two or three clinics, the successful teacher, attracting the larger number, might reap a comparatively rich harvest. The existence of prizes of this kind was to some extent stimulating, though perhaps less so than one would imagine, since, as a matter of experience, a considerable proportion of the abler men continued to go into the fundamental branches, where the financial possibilities were distinctly smaller.[3] But, whatever the possible advantage, the disadvantages were greater: for payment by fees gave the German professor a proprietary interest in the lecture system, by which he was enabled to hold together a large class, from each member of which he derived income.[4]

It was not the professor alone whose total cost did not appear in the budget. I have already called attention to the authorized teaching carried on "privately"—i.e., at the risk and on the initiative of individuals whose competency is vouched for by the university's authorization—and also to additional courses of a practical kind offered by assistants who utilize the resources of the institute with which they are connected. The fees in such cases are matters of personal arrangement between teacher and student. The cost of medical education would be by so much higher than the official accounts indicate, if these fees were included. Nevertheless,

[2] In case of clinicians the hospital paid a share: if the hospital was an endowed or municipal institution, the expenditure of the state (i.e., the university) was correspondingly reduced.

[3] However, the *Ordinarius* in a laboratory subject could earn a handsome income, since all students were required to follow (and pay for) his course of lectures.

[4] Various reforms are under consideration in Germany, as, for example, payment of a fixed salary, collection of fees up to a fixed maximum, all fees above this maximum to go to the state. See Becker, loc. cit., pp. 58 ff.; Lubarsch, loc. cit., pp. 60 ff.

though the total thus changing hands was substantial, the usual earnings of the individual instructor under this system were extremely modest, for the German docent, infatuated with science and knowing full well that promotion and distinction depended, in general, on performance, willingly spent years, with no positive assurance of ultimate recognition, on a small income, laboring at teaching and investigation. The deprivations involved in waiting acted as a sieve: the academic career was attractive by reason of the esteem in which it was held and the possibilities of distinction and comfort connected with it; but men who did not at heart care for science itself were not likely to put up with its hardships and uncertainties. Thus, at a minimum cost to society and almost no cost to the university, not only were important teaching functions discharged, but, to employ a metaphor from forestry, a "nursery" was maintained, from which, from time to time, the professional tree was transplanted.

Finally, the budgets of the several medical faculties had all increased rapidly within a period of, say, twenty to thirty years. Germany discovered a generation ago that the introduction of scientific methods of caring for patients, teaching, and investigation was relatively costly. Within three decades (1870-1905) the official outlay of the Prussian medical faculties, which does not include fees paid directly by the student to his instructor, increased five hundred per cent. Even so the totals were not in themselves startling—and for two general reasons: first, the purchasing power of the mark was high; second, the standard of university living in Northern Europe was extremely modest. Certainly, for the same total, less could have been contemporaneously procured in Great Britain and still less in the United States. The absolute sums expended are, however, of less interest than the constant relative increase; and this is of importance, because it makes clear that countries which remained practically stagnant during those twenty years must be prepared suddenly to make expenditures out of all proportion to their previous efforts, if now they set

out to overtake and perhaps to surpass Germany in its prime.

Absolutely viewed, British and American expenditure was in 1914 far below the German level. Nevertheless, even so, an interesting development had taken place. In both these countries, medical education throughout the nineteenth century had been a profitable business. Towards the close of the century it ceased to pay; by the year 1910, it was generally carried on at a loss. The loss was not heavy in Great Britain, where, in general, the fees received from all students were consumed mainly in administration and in carrying the laboratory years. The same situation was coming to prevail in America; but even at that time, something like thirty out of 155 medical schools then in existence were spending more than they received in fees—of which perhaps a dozen were expending considerably more. These expenditures were, however, made in America, as in Great Britain, well nigh wholly on the laboratory courses of the first two years. Clinical instruction had ceased to be profitable to the instructors and had not yet begun to be costly to the institution. In both countries, the student in his clinical years paid fees which went largely to wipe out the deficit due to the laboratory years.

B—PRESENT SITUATION

II

Had medical science and medical education in 1920 remained in point of quality and extent precisely as in 1910, expenditures on a comparable basis would have had to increase materially, though variably, in all countries, in consequence of the decline in the purchasing power of money. Of the countries not involved in the war, Denmark sought to maintain the equilibrium by adding to the fixed salary a fluctuating sum determined by the official price index. In Holland, Switzerland, and Scandinavia, costs had so considerably increased that forward projects were halted. Meanwhile, it is an

astonishing fact that small countries like Switzerland and Holland—the former out of cantonal resources—continue to support medical faculties worthy of comparison with the corresponding institutions in Germany at their prime.[5] Additions to the budget for current support, adequate to maintain the former level of educational and scientific efficiency have, however, been only partly procured. Economies have had to be practised, cuts made, makeshifts introduced, gifts sought. To some extent the searching thus required is at intervals wholesome; but the resources of the several laboratories and clinics have always been so modest, so far below the sums that could have been employed, the continental professor is so careful a "housekeeper" that waste has probably always been minimal. Of all the smaller European countries it may be said that resources are not today available to maintain educational and scientific activity at the level reached a decade ago. The general situation is at a standstill—and yet not precisely at a standstill, for the fertile mind manages somehow to make progress, even while others are relatively, sometimes absolutely retrogressive.

In the matter of financial support France can hardly be said to have held its own. The franc has lost greatly in purchasing power; and salaries have been increased so as only in part to meet the loss. In the provincial universities, the professorial salary ranged in 1921 from 19,000 francs to 25,000 francs, in Paris, from 24,000 to 28,000; the provincial *agrégé* draws from 8,000 to 13,000 francs, the Parisian from 11,000 to 17,000.[6] When, as happens, the *agrégé* is chief of a laboratory, his salary is augmented to the extent of ten or twelve thousand francs. Faculty budgets have also been augmented, though not sufficiently to avoid hardship. But the

[5] Prior to the war, foreign students in large numbers resorted to the Swiss universities; the depreciation of currency in many countries, as compared with Swiss currency, has greatly reduced the number of foreign students in Switzerland. The universities are in consequence seriously handicapped by loss of income from student fees.

[6] These sums have been increased as the franc has depreciated.

French type of organization and instruction suffers less damage from a financial pinch than the more highly developed and expensive forms of education and research cultivated by the universities to the North.

The medical faculties of Germany and Austria suffered most disastrously, because, being most highly developed and most liberally supported before the war, they suddenly found themselves forced to live from hand to mouth, struggling neither to grow nor to maintain the status quo, but to survive. For a time, in consequence of the depreciation and instability of the currency, it was impossible to speak of the cost of medical education in Germany and Austria. Chaos ruled; men did what they could, living from hand to mouth. With the introduction of the rentenmark, stability was procured, and the universities were promptly budgeted. A few concrete examples will convey some notion as to how the present situation compares with that at the opening of the war. The cost of food is perhaps not more than 10 per cent. above the corresponding prices in 1913; but the price of apparatus has risen 40 per cent., the price of chemicals 50 per cent. Meanwhile, budgets should have risen; had they remained the same, the scientific institutes would have been badly off; as a matter of fact they have declined: that of a representative anatomical institute from 12,900 to 8,800 marks, of a physiological institute, from 15,400 to 10,700 marks, of a pathological institute from 6,400 to 4,600, of a pharmacological institute from 4,300 to 3,200 marks, of a hygienic institute from 5,250 to 3,900 marks, of certain clinics from 239,000 to 116,000. That is, at a time when apparatus and chemicals have risen almost one-half in price, a group of scientific institutes are conducted on a budget decreased by about one-third. Meanwhile, the cost of living having increased 10 per cent., the income (salaries and fees) of the professors, who conduct the institutes above named, has decreased about 23 per cent.[7]

[7] The figures used are official, as of date January, 1924.

But the damage done by the war is far in excess of that represented by official figures. In Germany, far beyond any other country, large and important activities found no record in the university budget. There was, as I have already said, an army of workers with titles, but without budget or salary or with insufficient budget or salary. They obtained facilities and support from private resources, from fees paid by students for voluntary courses, or in other ways. The richness, variety, and vigor of the German university were in no small measure due to the host of teachers and investigators in question. The stabilized budget does nothing for them, and the sources from which they once derived support have been cut off. The organization remains on paper intact; but the former full-time worker and teacher now supplements his income by any form of drudgery obtainable; books, apparatus, and supplies, whether for teaching, care of the sick, or research, are inadequately obtained, despite the effort at self-help,[8] aid derived from philanthropic organizations in other countries, and subventions from German industry in fields that promise an economic return. Meanwhile, the personnel, which is after all the one great asset, has been seriously damaged; the "nursery"—the throng of young enthusiastic workers, willing on hard terms to take the risks involved in an academic career—out of which recruits have previously been obtained, has been gravely injured. Yet scientific work is vigorously carried on, despite difficult conditions. But no one can count the cost, nor can any one yet estimate how much ground Germany has lost.

III

The situation is different in England and very different in the United States. In so far as concerns the effort to avoid deterioration, England does not differ in principle from Denmark or Switzerland, except that it was naturally easier to maintain the less advanced English position. Even so, it may

[8] Represented by the *Notgemeinschaft der deutschen Wissenschaften*.

be estimated that services and supplies of a general character cost 70 per cent. more today than in 1912. However, ten medical schools, whose total expenditure was in 1912 £61,038, spent in 1921 £170,491—an increase of practically 180 per cent.—though the totals are still relatively small. The English medical schools have thus, in face of extraordinarily difficult conditions, not only held their own, but have made some headway. Towards this end, the government has lent important aid, making annual grants in aid that, totalling £14,671 to 10 schools in 1912, increased to £95,270 to 14 schools in 1922. In addition, the government in 1924 distributed through the Medical Research Council £135,000 for the promotion of research and the training of investigators.[9] Thus, of European countries, Great Britain is alone, relatively, doing better by medical education than in the years just prior to the war.

Meanwhile, it must be remembered that at the earlier date Great Britain was probably doing less for medical education than any other country in Western Europe. It was indeed at the outbreak of the war just awakening to the necessity of strengthening its position in medicine. The physical defects of the conscript army, the problem of nourishing the home population during the war, medical and surgical experience in the field—all reinforced a decision arrived at just before the war broke out that medical teaching and research must be more liberally supported.[10] Private donors and philanthropic agencies abroad have coöperated in this effort. Enormously greater sums will, however, be required in Great Britain to provide modern facilities and to maintain a competent and well organized scientific personnel; for British expenditure, even with these subventions, lags far behind that of the smaller continental countries and of America today, as it does behind the German or Austrian pre-war level.

[9] This sum should be compared with the grant of £50,000 originally made (1913-1914).

[10] See, for example, the *Report of the Commission on University Education in London*, 1913.

IV

The American situation differs mainly in degree from that just described as existing in England. Excepting a very small number of institutions, American schools were fifteen years ago worse off than British schools. Despite rising prices, our resources would not have been greatly taxed to preserve the same level. It is estimated that a medical school which stood still would in 1922 have spent 75 per cent. more than in 1910. Thus Johns Hopkins, spending little above $100,000 a year in 1910, Harvard spending something over $250,000, Washington University $52,000, Iowa, $35,000, Yale less than $50,000 at the same date, could probably have preserved the scale and efficiency of that day, by expending, respectively, $175,000, $437,500, $91,000, $61,250, and $87,500 in 1922.[11] As a matter of fact, the Hopkins budget has risen to $550,000 (an increase of 450 per cent.), the Harvard budget to $545,000 (an increase of 118 per cent.), the Washington University budget to $357,000 (an increase of 586 per cent.), the Iowa budget to $350,000 (an increase of 900 per cent.), the Yale budget to $375,000 (an increase of 650 per cent.).[12] Typical of

[11] The multiplier used, 175 per cent., represents a fair estimate of the increase in costs between 1910 and 1922.

[12] The total budgets are not strictly comparable, since they do not always contain precisely the same items. Thus some of the schools pay for items that are elsewhere paid for by the hospitals in which the teaching is done, etc. But the general picture is correct.

The increase of endowment specifically obtained for medical schools is shown in the following table:

Institution	Endowment 1910	Endowment 1924
Johns Hopkins Medical School	$437,581	$7,504,956
Yale Medical School	278,099	4,162,871
Washington University School of Medicine	None	4,883,375
Harvard Medical School	3,216,197	7,339.671
McGill Medical School	268,050	2,509,400
University of Toronto Medical Department	None	1,083,600

modest schools very unsatisfactory at the earlier date, but now striving upwards, the medical department of one of the smaller western state universities, which spent in 1915 a total of $25,145, had in 1922 a budget of $133,000 (an increase of 428 per cent.). Similarly, the medical department of a state university in the southwest, with, twelve years ago, a total budget of slightly over $60,000—then a liberal expenditure, all things considered—now spends slightly over $160,000—an increase of almost 170 per cent.; a western state university, which was then spending $35,000 on its medical department, is now spending over $200,000, an increase of 471 per cent.; another western university, in better condition in 1910, has advanced from approximately $70,000 annually to something over $225,000, an increase of over 200 per cent.; still another that in 1912-1913 expended $100,470 spends in the current year $270,000—an increase of almost 170 per cent. Among endowed institutions one in the southwest, conducted in the fashion of that day at a cost of $50,000 a year, costs in annual maintenance almost $300,000, now that plants and methods have been modernized—an increase slightly below 500 per cent. Throughout the country schools have by the score doubled or more than doubled their expenditure in 1910. Meanwhile, millions have been expended on plant and equipment. On a somewhat reduced scale the same phenomenon has been witnessed in Canada. McGill's total expenditure on its medical faculty in 1912-1913 was $91,857, Toronto's $108,860. To remain in statu quo, McGill would have spent in 1923 approximately $160,000, Toronto $190,000. In fact, the McGill budget in that year reached $345,643, an increase of 276 per cent. and Toronto $333,270, an increase of 206 per cent. Though the figures above given are not strictly comparable in all details, the trend and extent of the development are unmistakable; let us consider what they signify.

In the first instance in America, prices, already higher than in Europe, have still further risen. Meanwhile, an era of rapidly rising ideals coincided with the era of rapidly rising

prices. Under, financially, the most difficult conditions with which higher education has yet had to cope, a country-wide attempt to raise the standard of medical education has gone swiftly forward. In 1910 the country was, like England, far behind the times; great expenditure in a brief period was therefore urgent. Meanwhile, the leaders in medical education undertook far more than was anywhere else undertaken—though not in general more than had been somewhere else accomplished. Finally, in the same period, especially in centers of population, the standard of comfort and convenience, already far in advance of that abroad, has still further advanced. Fifteen years ago, on a maximum salary of $5,000, the full-time professor of a laboratory subject in the best American medical school could lead a fairly comfortable life of academic type. A salary of $8,750 would—if our multiplier is correct—be requisite today—a scale that has been nowhere attained. As a matter of fact, though salaries have risen markedly, they have not kept pace with the rise in the cost of living, increased general expenditures having been devoted rather more than proportionately to expansion of teaching and research activities.

A genuine problem arises in this connection, which may as well be touched on in passing. Whatever the genius may put up with in order to work, universities must in the long run be conducted by human beings, who, however able and devoted, will, if pressed too hard, be compelled to seek another sphere of activity in which they can make prudent and proper provision for their families. The less able will, of course, do as well in education as anywhere else; the more able, whatever their personal preferences for university life, can carry their talents elsewhere, often without wholly abandoning scientific interests. The best are, however, none too good for medical education and investigation. The moral is plain: the medical faculty cannot and must not compete financially with worldly occupations; but it must, in the long run, offer salaries adequate to enable the competent professor to live at the level prescribed

by custom and common practice. Hardship is wholesome and stimulating to the beginner; but men who have won their laurels must feel sure of a pension and a competence such as will enable them to educate their children, to enjoy a holiday, and in academic simplicity to cultivate the friendship of people and books.

Aside, however, from the higher scale of prices, whether due to fall in value of money or elevation in the margin of well-being, increased costs on the laboratory side in schools that were ten years ago distinctly inferior represent mainly the effort to offer reasonably competent and practical instruction in the essentials. Thus, four medical schools which existed ten years ago on total expenditures ranging from $15,000 to $40,000 per annum, are now each expending from $80,000 to $130,000 a year; and these sums merely support (besides general expense, itself far higher because more is undertaken) a full-time teacher with the minimum of assistance and maintenance in each of the fundamental laboratory branches.

Much larger sums—ranging from $30,000 to $50,000—are spent on each of the laboratory subjects in institutions which have developed optional courses and research, requiring better equipment, a larger and more highly specialized staff, experimental facilities, books and current journals, foreign and domestic. Ten years ago, for example, pathology was at Yale an undeveloped subject, carried at a negligible cost; today it occupies an institute, simply built, to be sure, but comparable in facilities and scope to the pathological institute of a German university. The expenditure has increased from next to nothing up to $35,000 a year. The leap is startling: part of it is due to increased cost in general, but most to the fact that an active teaching and investigating laboratory has been built up out of nothing in the course of a few years. Had Yale possessed a proper laboratory a decade ago, it would still be paying more for pathology today, but the transition would have been somewhat gradual, rather than strikingly abrupt. Again, in the year 1910, Johns Hopkins carried fertile labora-

tories of anatomy, pathology [13] and physiology,[14] on an annual expenditure, in round numbers of $15,000 each; Columbia, the same subjects, on an average expenditure of slightly over $20,000 each. Five institutions of the most active type are today annually spending on anatomy sums ranging from $26,-000 to $43,000; on physiology (not including a sub-department of biochemistry) from $20,000 to $30,000; on pathology (not including a sub-department of bacteriology) from $20,000 to $40,000.[15] Three substantial institutions, excellent, though less elaborate, spend on anatomy from $16,000 to $20,000 a year, on physiology from $13,000 to $18,000, on pathology from $17,000 to $20,000. With these increased budgets there have necessarily been associated in many places larger capital investments in buildings and equipment.

Generally speaking, then, modest institutions, doing fairly satisfactory teaching and enabling their staff to find a little time for research, are today expending in the laboratory subjects rather more than the leading and most productive schools spent twelve years ago; the leading schools have doubled, in some cases more than doubled, the maximum expenditure at that time.

The point hardly requires further elaboration. Assuming for the moment that these larger budgets are carefully expended, the rise in cost is explicable, partly by the depreciation in the value of the dollar, partly by the expansion of ideas, partly by a rise in the standard of living. A decade ago, when there was little in the country at large, a modestly equipped laboratory, doing a variable amount of research, was a creditable thing. Comparison with Germany no one thought of instituting. But in recent years, our medical scientists have very properly challenged themselves to do the best; and they could not make such bricks without the right kind and amount of

[13] Including bacteriology in a subordinate position.

[14] Including biochemistry in a subordinate position.

[15] Bacteriology, when developed as a separate department, costs in these institutions from $15,000 to $25,000 a year.

straw. The effort to do better by their students and more for science is reflected in the budget. Even so, many institutions—a few in the east, more in the west, still more in the south—possess as yet only skeleton organizations and equipment in the laboratory subjects.

On the clinical side, progress has been on the whole less pronounced, though in a few places it has amounted to a transformation. I have said that in Europe conditions have not perceptibly altered in respect to control of facilities or amount of material. Countries which were in these respects well-off before 1914 continue well-off; countries in which educational control was then hampered and the amount of material under educational control was then limited have not materially changed. No expenditure of general significance has been made with a view to effecting radical improvement in the clinics in countries such as Great Britain and France, where general improvement was and is urgently needed. In the United States, the hospital and medical school development already described has involved large investment and requires increased annual budgets. In so far as the costs of hospital support are borne by subscription or endowment,[16] no account need be taken in estimating the cost of the medical school—though, as we shall see, popular subscription does not undertake to provide for teaching or research; in so far as hospital maintenance is provided by the state, even where, as in Michigan, Iowa, Wisconsin, and Nebraska, for the express purpose of aiding in medical education, the hospital as such may still be regarded as the state's rather than the university's way of discharging an obligation to the sick poor, which exists independently of the problems of training physicians and advancing knowledge. Most of the increased cost of more and better clinical facilities has been thus borne by philanthropic agencies or by separate taxation—and this, as I shall later point out, is sound in theory, as it is successful in practice. Not all, however; the new school at Rochester (N. Y.), the reorganized schools at Chicago

[16] As in case of certain clinics in Boston and St. Louis, for example.

and Nashville are compelled, out of their own funds, to establish small university hospitals, thus greatly increasing the strain on the university's resources; other universities are also at times compelled to contribute to the hospital chest, in order to improve the hospital, as such. The situation in the United States differs, then, from the situation abroad in respect to the larger sums that have been expended to improve the clinical situation —an expenditure for which there was no occasion in Northern Europe, and which has not been made, though occasion is not lacking, in Great Britain or France.

But it is in respect to the situation of clinical teaching and research in America that the greatest changes have taken place. Ten or twelve years ago no medical school was put to much expense to provide clinical teaching. A few modest salaries were paid in Baltimore, Ann Arbor, and Boston; a modest expenditure was incurred for instruction in clinical microscopy and physical diagnosis. That was all. Otherwise clinical teaching was carried practically without cost to the school; nay, more, it was a source of profit to the school, for fees paid by students in the clinical years went to wipe out the deficit incurred in maintaining the first two years. Research, where carried on, was frequently paid for by the professor out of his professional income.

At the present time the medical school, apart from the hospital, endeavors to provide money for clinical teaching under one or more of several heads. The routine clinical laboratory connected with the wards contains space and facilities for the ward clerks who, in the best of the American schools, make the requisite examinations under closer supervision than usually obtains abroad. In this work they are supervised by interns and residents, more numerous than the corresponding house officers in Europe. The extension of facilities and staff thus required is, at times, partly a charge upon the medical school.

But the few best organized American clinics, as I have pointed out, utilize for teaching, care of patients, and research, chemical and biological methods more thoroughly than does

even the advanced German clinic. These laboratories cannot possibly be manned with volunteers; paid workers are required, sometimes on half time, by no means infrequently on full time. Supplies and apparatus, going far beyond ordinary hospital needs, are requisite. The expense involved in research and in teaching and treatment thus linked with research often falls in whole or part upon the medical school.

Finally, the clinic itself can no longer be conducted by volunteers. The old order, with its cursory visits by busy practitioners, has in most sections of the country largely passed away. Wherever hospital work, and especially teaching as part of hospital work, are seriously taken, the visiting staff is held to longer attendance and more thorough work. The payment of an honorarium is therefore becoming more common. In case a somewhat definite understanding exists to the effect that the visiting staff is to devote half the day to the hospital, a salary that is more than nominal is paid. A growing number of schools have, however, as we have learned, discovered that half time is itself inadequate. These schools, on the basis of a definite understanding, remunerate at least the members of the central group, responsible for the conduct of the clinic, on an academic basis. The persons in question receive salaries, which at Johns Hopkins, Yale, Chicago, Rochester, Washington (St. Louis), and Vanderbilt are regarded as full and sole remuneration; at Harvard, a margin exists, permitting a somewhat smaller salary, to be supplemented by income from a limited consultation practice. In any event, on the score of the various developments which I have sketched, all of which have taken place at half a dozen institutions and some of which have taken place at perhaps twenty or thirty more, many medical schools find themselves compelled to provide funds for the educational and scientific work of the clinics. On the other hand, in a goodly number volunteers still carry on the clinical teaching, and the fees paid by students in the clinical years are diverted to the support of the pre-clinical laboratories.

Thus, three prominent institutions in the United States

frankly operating on the part-time basis—imposing, that is, on the heads of departments no definite restriction as to the extent or manner of their private practice—expend on the staff in the department of medicine sums that range from $25,000 to $52,000 annually. These budgets provide salaries for the part-time clinical departmental heads in the neighborhood of $5,000 a year, salaries on a regular academic basis for full-time scientific workers in the laboratories, technicians, servants, supplies, etc. Three other institutions in the United States, the bulk of whose work in the medical clinic is carried by the full-time staff in receipt of no income except their salaries, expend from $35,000 to $80,000 a year, while at Toronto a staff, approaching the rigid full-time organization, now requires $49,260. In surgery, the part-time schools, which remunerate the heads on the same basis as in medicine, and in addition a smaller full-time group working in experimental laboratories, spend approximately $25,000 each a year, while the full-time schools operate on budgets of approximately $50,000. In pediatrics, the part-time schools in the above group require from $8,000 to $12,000 a year, while the outright full-time schools spend from $25,000 to $35,000. In obstetrics the part-time schools require from $5,000 to $14,000, while the full-time department at Johns Hopkins begins with a budget of $30,570.

The burden upon some comparatively unpretentious schools is by no means negligible. Of three schools of this description already cited in discussing the laboratory subjects, one spends $20,000 a year on medicine and surgery (a sum that would have carried two full-time laboratory departments fifteen years ago); the second, $65,000 on part-time departments of medicine, surgery, pediatrics, and obstetrics (an average of $16,000, decidedly above the cost of good full-time laboratory departments in 1910); the third, $28,470 on medicine, surgery, and obstetrics, once more an average approaching $10,000 a year each. Small sums, in the nature of honoraria, are paid to teachers in other clinical departments. The total is far from inconsiderable; capitalized at 5 per cent. it represents endowment far

in excess of the wealth of any medical school in America a decade ago. Even the less ambitious schools have been forced to abandon absolutely voluntary service. This great load is practically altogether the product of the efforts and ambitions of the decade just passed. It represents the assumption of responsibilities and opportunities to which no medical school was alive at the former date.[17]

V

Expenditure is on one account even greater relatively than appears from the preceding sketch. The medical school of a generation ago was not sensitive on the score of numbers. Employing mass instruction more or less generally, it admitted almost indefinitely those who complied with entrance requirements, if there were any; and the critical sense of the admitting officer was rarely too acute. Beginning fifteen years ago, more or less, entrance requirements have become higher and more exacting; as the successive changes were introduced, the enrollment fell—only, however, to rise towards the old level, after a brief period. With the spread of a scientific conception of medicine, practical training of the individual has come to the fore; teachers of medicine insist that, if the student is to learn by doing, his doing must be closely supervised. Hence, enrollment is limited on the basis of facilities and staff. Stanford, for example, admits approximately 25 to each class;[18] Johns Hopkins, which used to admit 100, has successively reduced its classes to 90, 75, 66; the new Vanderbilt and the

[17] The figures above given are not strictly comparable, but are cited to show tendencies and results thus far. In some instances they understate cost, since some hospitals pay salaries or honoraria that do not appear in the school accounts. Again, some of the schools concentrate most of their expenditure on one medical or surgical clinic, while others spread it over two or three.

[18] Steps are, however, being taken to enlarge the classes; the present first year class (1924) numbers 60.

new Chicago schools are planned for classes not to exceed 50.[19] Obviously, virtual cost is larger than appears, if increased budgets provide only for teaching a reduced number of students. On the other hand, one must not forget that the productive work of the schools has become much more voluminous and important.

Finally, certain other items involving considerable increase in expense have to be taken into account. Buildings constructed in the last decade are almost invariably more elaborate and more elegant than previously; they will endure longer and require less in the way of repair. But they cost more to run, since—quite aside from architectural good taste, which costs something—they are fitted up with all sorts of appliances, contrivances, and devices, that, while designed to save labor, sometimes so complicate life as greatly and needlessly to increase it. Thus more money and more time are sometimes expended on details that distract from the vital concerns of science and education. Again, administration, altogether too loose in America a decade ago, and blissfully simple and inexpensive everywhere in Europe, has become in America "efficient"—and correspondingly expensive. In five of the schools utilized as examples in the preceding pages, the dean's office costs from a little above $9,000 to slightly over $22,000 a year. In the latter institution the entire income of the endowment, on the basis of which Johns Hopkins Medical School opened its doors, would scarcely suffice, after an interval of only thirty years, to pay for "administration" alone. The point is one to which I have already adverted: the American tends to over-organize and into over-organization he tends to divert ability, energy, and funds that

[19] The uniform and rigid curriculum is, of course, also in part responsible for the limitation of numbers. If, for example, every student must take experimental physiology of the same kind and at the same time, just so many students can be accepted in each class and no more. But if students could reach their goal, by taking, to some extent at least, different subjects and at different times—the way in which men really get themselves trained, despite the curriculum—larger numbers could be received. Of course, this is not to be understood as an apology for such huge schools as those of Paris, Berlin, and Vienna, where numbers are so great that effective teaching is impossible.

could be more fruitfully employed. The "office" of an American university, in general, and of the medical school in particular, with its clerical staff, filing systems, records, telephones, and messengers, has no counterpart abroad. It is a question whether education is correspondingly more effective or research correspondingly more productive. Between the European professor, who writes with his own hand, and the American, with the push button, there is perhaps a reasonable mean, yet to be discovered.

VI

The figures which we have discussed above would in the United States be less disturbing, if we were in position to say that the country as a whole had made up for lost time and could now look forward to steady, gradual progress. Such is, however, very far from the fact. Let us assume that the needs of the United States in the matter of mere number of physicians could be supplied by thirty odd medical schools graduating annually, on the average, ninety physicians each. Of these institutions, all probably destined to continue, most have access to a sufficient supply of medical and surgical cases; yet hardly over a dozen can be fairly considered to be now conducting modern teaching clinics—I have in mind as a minimum a standard far below the modern conception in its rigorous form—in medicine, and probably not exceeding ten, as conducting modern teaching clinics in surgery; some fifteen have access to a differentiated supply of material in diseases of children, of which not exceeding half a dozen may be classified as pediatric clinics; access to obstetrical cases more or less adequate in number is fairly general, but only one modern woman's clinic, comparable with that at Copenhagen, has thus far been created in America; psychiatric clinics of university type exist in half a dozen places; a neurological clinic like Winkler's at Utrecht does not yet exist; nor a dermatological clinic like Pautrier's at Strasbourg or Rasch's at Copenhagen.

Of homogeneously complete faculties such as exist in practically every university of Northern Europe, the country does not today possess a single one. The missing clinics must be supplied—how, we shall shortly consider. But even if supplied, the task of the universities in furnishing a proper teaching staff remains enormous. With all the splendid progress of the last fifteen years, we are therefore only on the threshold. If the country is to attain, in course of time, the symmetrical development long ago reached and still on the whole maintained in certain continental countries, the major investment has still to be made. Our experience up to this time and policies now under consideration need to be carefully scrutinized in order that the sums calculated to be necessary may not be needlessly swollen, and in order that expenditures, great in any case, may tell as effectively as possible.

It is, in the first instance, clear that hospital support as such, should not fall upon the university. The care of the sick is a community obligation; in the community's interest physicians should be well trained and medical science must be advanced. It is therefore the business of the community, through state, county, city, or philanthropic bodies, adopting the policy which has prevailed on the continent, to make hospitals sufficient in size and variety unconditionally available to universities that are prepared to organize them efficiently as teaching institutions. To be sure, teaching and research increase hospital costs, and such increase the university must obviously be prepared to carry.[20] In the past, and largely enough still, hospitals have been and are available on condition that in respect to the staff the medical schools refrain from doing this very thing—i.e., teaching has been permitted, provided schools accept as professors the local practising profession, or in certain important features continue to be hospitals rather than clinics. These

[20] This is common practice in Germany, Switzerland, etc. In Switzerland, for example, the canton which utilizes non-cantonal hospitals for medical instruction, pays all educational and scientific costs thereby incurred. At Bern this amounted in 1923 to one-third of the budget of the medical school.

limitations are serious bars to the best possible care of patients, to sound education and to scientific progress. It would be far better if hospitals declined to enter into relations with a medical school that is not strong enough financially to conduct a modern teaching establishment. Even so, hospitals in abundance will be left to the local profession.

The state universities are in this matter on the right track.[21] The University of Michigan has long controlled in the interest of education a university hospital ultimately supported by local taxation; Iowa, having from time to time to enlarge its university hospital, now maintained at a cost to the state treasury of over $700,000 a year, has begun the construction of an entire new plant, which, when completed on the basis adopted, will provide a set of clinics nowhere surpassed in the country; Minnesota, Indiana, and Texas are among the states that still have to rely largely on municipal or endowed hospitals not fully controlled for their respective clinical facilities. The University of Cincinnati, a municipal university, enjoys complete control of the new city hospital; and the university has been able to call outsiders to professorships of medicine, surgery, and pediatrics.

Endowed institutions have to resort to various expedients. To make a right start, in an absolutely untrammeled fashion, the University of Chicago, the University of Rochester, and Vanderbilt University have had to undertake to create a university hospital as a nucleus. Fully half of their initial cash resources, running from five to ten millions, is thus in advance bespoken for the construction and maintenance of hospital units which the community should furnish. Could this investment and expenditure have been avoided, the educational future of the institutions would be clear for years to come. It is plain that without the coöperation of philanthropic bodies and municipal authorities, which will build or

[21] The details vary considerably, however: thus in Iowa the entire cost of the university hospital is borne by the state treasury; in Michigan, the state is reimbursed by the counties, etc.

rebuild their respective hospitals on the university campus, none of these schools can be properly developed. The City of Rochester has given the entire country an object lesson by contracting with the university to build adjoining the small university hospital a city hospital, of which the university shall possess sole and complete teaching control. In Boston, the city maintains at the municipal hospital a modern medical clinic, the laboratories being provided by endowment, which is at the moment completely utilized by the Harvard Medical School. There are not lacking indications that sound ideas are in this matter coming to prevail. At Boston, New York, Cleveland, St. Louis, New Haven, and other places, general and special hospitals are either building or rebuilding in close contiguity to the medical laboratories on the basis of contracts—or, what may be equally effective—an understanding, which creates university clinics, the current maintenance of which, as hospitals, is provided by hospital managers and trustees. At Toronto and Montreal, excellent hospitals, maintained by accumulated endowments and subscriptions, are utilized by their respective local universities. The group of hospitals surrounding the Harvard Medical School consists of several institutions, separately maintained each by a group of interested persons, yet all serving in their respective fields the medical faculty; again in St. Louis, the Barnes Hospital, containing the medical and surgical clinics, is supported partly by endowment, partly by the community; the Children's Hospital and the Women's Clinic are maintained by the women of the city—forming together an excellent group representing the main clinical subjects. Special hospitals need to be added to these and similar aggregations elsewhere. Further progress depends on the education of public sentiment.[22] In any case on the hospital side, the

[22] The situation is not, however, without difficulty: hospitals, supported by subscription and endowment, are usually "family affairs"—managers, subscribers, and staff being closely connected, socially and philanthropically, with one another. When an established hospital of this kind is converted into a university hospital in the strict sense of the term, the local staff is replaced by a staff called together, like any other university

situation is in principle simple: in one form or another, the community must provide the university with the requisite clinical facilities under conditions that not only permit but require the university to introduce a teaching and investigating staff.

The support and management of medical education, as is clear from the preceding account, are in America a state function, especially in the west and south; a matter of private initiative, especially in the east. On its face, it looks easier to raise the required funds by taxation than by endowment: for a small state-wide tax will produce a large sum, while a capital of $1,000,000 must be procured in order to add $50,000 to the income of an endowed institution. Thus far, in practice, however, endowed institutions have on the whole incontestably led. Whether they will continue to lead depends on the possibility of educating democracies to pay taxes not only to maintain hospitals, but to promote education and research. One wonders whether the great states will some day emulate one another in the support of universities devoted to the cultivation of learning, as the German states and principalities and the Swiss cantons, with their inferior natural resources, have heretofore done! [23]

VII

The rapid progress of recent years, contrasting strongly with the absolute poverty previously prevailing, has produced in

faculty, from all parts of the country. The pay ward shrinks in importance and becomes less profitable to the institutions; it ceases also to be of use to the general local profession. Will the public and the profession continue to support the enterprise, which has really become more important, not less important, for it renders the same philanthropic service as formerly, and a wider educational and scientific service? Once more, it is a problem of educating public and professional sentiment. A similar difficulty must be surmounted in Great Britain, if the voluntary hospitals are to become university hospitals. Thus far, though astonishing progress has been made, long established hospitals have either been only partly and cautiously reorganized, or, if thoroughly reorganized, have not entirely recovered from the shock.

[23] The argument in the text is as applicable to England and Scotland as to America.

America a somewhat hectic atmosphere, not wholly favorable to economy. For the moment, administrators, full of energy and ambition—both badly needed and not therefore to be rudely suppressed—may be from time to time gently reminded that small sums may still accomplish great things. The Swiss universities, hopeless of ever obtaining large support, are active hives of scientific investigation. At Cambridge and Stockholm a powerful tradition offsets inadequate means. The most striking medical advance of the last few years, the discovery of insulin, was made with an expenditure of a few thousand dollars. Meager funds do not excuse inactivity. On the other hand, let me not be misunderstood. Banting's work on insulin required not only an idea and the modest sum above mentioned, but the aid and environment of a well developed medical school, particularly a well developed department of physiology, which could not have itself existed without other departments, all more or less costly—not to mention laboratories in every quarter, which had been for years gradually contributing this fact or that to the structure which Banting and his colleagues completed. There is, besides, legitimate need for large resources to supply missing links and to provide for certain types of activity that cannot be inexpensively prosecuted. Modesty and elaborateness of expenditure can both be justified, and are both required. Ideals are nevertheless more important than money; money is less important than men. The poorer nation, with idealism, may in the end surpass the wealthier, without. The suddenness, however, with which in the United States undreamed-of sums have been obtained within a short period has proved somewhat intoxicating. Far too much time and attention have been devoted to calculating what could be accomplished, if certain impossible sums could be obtained, or what it would cost if entire departments could be rounded out so that, to refer to a concrete case, every instructor might find one half of his time reserved inviolate for research apart from teaching. On this basis, new enterprises requiring at once from \$15,000,000 to \$20,000,000 have been projected; expansions

involving millions have been outlined; and the educational cost of conducting a single medical clinic teaching 100 students has been figured at something between a minimum of $100,000 a year and a maximum of close to $200,000 a year—that is, the income at 5 per cent. of something between $2,000,000 and $4,000,000.

It is not, to be sure, altogether idle to dream dreams; but it is, even in our dreams, or perhaps most of all in our dreams, important not to forget that, in its present complexity, no single science, and still less the large group of sciences comprised in the medical faculty, can be schematically organized and developed. The schematic organization of a given department would almost inevitably be so weak in certain spots as to imperil the soundness of the structure; schematic organization of the department in question in a number of institutions simultaneously could not possibly be carried through at all; schematic organization of an entire school would be absolutely impracticable even were the funds obtainable. Indeed, the notion of advancing science by schematic institutional organization is fundamentally fallacious. For the entire scientific world must be viewed as one organism, working harmoniously, though variously, towards its goal. Small groups need, of course, to be brought together under as favorable conditions as possible, at different foci; this is necessary for education and for mutual stimulus. Beyond this, it is immaterial where or by whom progress is made, for, wherever made, it is common property. Millions would be vainly spent in the effort so to round out a department or school as to make it "complete." In general, it is on men, not on schemes of organization, that income should be spent. Professor Howland, urging the importance of both chemical and bacteriological teaching and research in pediatrics, nevertheless very soundly adds: "I feel very strongly that it is not necessary to fill positions unless a competent man is available; if a good bacteriologist, interested in diseases of children, cannot be found, it would be best to rely on the bacteriological department for advice; the same may be

said of chemistry." Mobility of funds should therefore be aimed at; and money should, within limits, be flexibly diverted from this place to that, according as productive opportunities arise. From time to time, particularly as changes of personnel occur, funds should be redistributed so that income may not require constantly to be increased. Indeed, scrutiny enforced by a budget that cannot be expanded at will is a wholesome, not an unwholesome ordeal. Thus the total needed will be reduced; and sums available will be utilized to best advantage.

VIII

I have already called attention to the scale on which the part-time clinical staff is now remunerated. Is it not, however, worth inquiring whether a university which pays a professor of pathology or anatomy $7,500 to $8,000 ought to have to find a salary of $4,000 to $5,000 for a part-time professor of medicine or surgery? The clinician's time goes mainly to care of patients; his teaching is incidental, and it is indirectly very remunerative; as physician or surgeon, he should receive compensation in some form from the hospital; as teacher, he can hardly claim more than an honorarium. The more conscientious performance of hospital and school duties, characteristic of recent years, is not, I believe, largely due to payment of salary; for the improvement is more or less general, the salary still limited to institutions having considerable means. It is rather to be attributed to better morale, due partly to criticism, partly to comparison with the whole-time system: for, clearly, if one institution finds it necessary to procure full time, another, emulous of similar status, cannot be satisfied with cursory service. The burden of medical school finance would be very much lightened if the hospital remunerated the staff for services rendered to the hospital, while the school paid for clinical teaching what it is fairly worth when compared with laboratory teaching and laboratory salaries.[24] The indirect

[24] A few hospitals in the east already do this.

gain to the part-time clinician from his association with a medical school is surely an offset not to be wholly ignored. But the clinician's gain is not merely indirect; certain institutions now furnish the clinical staff consultation rooms and examination facilities, as well as all the conveniences of a private infirmary for their own pay-patients. It is difficult to see why clinicians enjoying such facilities for private practice should in addition receive two-thirds—or more—of the salary paid to the full-time laboratory professor.[25] The financial future of the medical school employing a part-time clinical staff will be less difficult, if this situation is sensibly handled.[26]

The problem is, however, not free of perplexity, even when limited to teachers on full time. The salary situation in American colleges and universities has in recent years improved, but is still far from satisfactory.[27] Dignity, respect, and interest will do something to attract men to scientific pursuits; but, at a time when these may be partly at least obtained in other remunerative careers—industrial and professional—the teacher must, as I have already insisted, be reasonably enabled to share —himself and his family—in the legitimate opportunities and enjoyment of life; his wife cannot continue a drudge, nor can his children be denied educational opportunity. To the extent that the medical faculty command salaries at a higher level, the good fortune of the teacher of anatomy or pathology is a wholesome influence; for it tends to elevate the general level.

[25] A small medical school with a total budget of less than $90,000 pays its laboratory professors $4,500 a year and its surgeon the same. To the latter it supplies private wards and laboratories without expense to him. His income from practice is estimated at many times his salary. The school pays him for his teaching, though it takes a relatively small part of his time; but *he* pays nothing towards the cost of the facilities he enjoys for carrying on his practice beyond, perhaps, a few assistants who help him.

[26] One should add that in Europe the clinical professor receives the same salary as any other.

[27] See Arnett's *Teachers' Salaries in Certain Endowed Colleges and Universities in the United States,* Occasional Papers No. 7, General Education Board (New York).

On the other hand, the medical faculty cannot be permitted to become an aristocracy; it cannot advance too far ahead of other faculties without creating ill-feeling on the part of colleagues, and such difficulties for administrators as may in the end make them as keen to drop medicine as they once were to take it up. The rest of the university cannot be forgotten; to be sure, the humanities, the general sciences—physics, chemistry, and biology—and athletics (gymnasium, stadium, etc.), all had their day in court before the medical faculty came to university self-consciousness. For a period, therefore, medicine could fairly claim relatively greater consideration; but this cannot continue indefinitely. And institutions which have latterly done relatively well by medicine must henceforth carry forward the medical program in some sort of harmony with the development of the rest of the institution.

The full-time clinician unquestionably carries a heavier burden than any other university professor, for he administers a hospital ward in addition to doing teaching and research. Part of his remuneration should either come from the hospital or be charged to hospital service; and his salary as professor of medicine should, in principle, be the same as would be paid to him as professor of anatomy or physiology. Even so, the academic status of the full-time clinician and his staff will be destroyed if the two items, taken together, lift him out of the academic class. And this is as true of juniors as of chiefs; a period of academic hardship has its uses in the case of the young full-time clinician as in the case of the youthful Hellenist or physicist. Scholarly and scientific zeal may well be thus tested on the threshold of the academic career.

The solution reached at Johns Hopkins, Washington University, Yale, and Rochester, where the full-time clinical chief is salaried on the average one-third more than his colleagues in the medical laboratories, has thus far worked well.[28] In the

[28] In a few cases, the difference has risen to 50 per cent. The difference below the grade of professor is at times higher—occasionally 100 per cent. This may be due to the fact that the associate professor of medicine

London units a similar policy has been successfully pursued. Thus the full-time clinician receives as professor the regular professorial salary, and for his additional services in the care of patients, further remuneration not out of proportion to the responsibility involved. Of these patients in America some pay fees for medical or surgical service; but in these the staff has no interest; they are absorbed by the school without affecting the remuneration of the individual or the group rendering the service. It is somewhat surprising to find how inconsiderable is the incidental income thus derived by the school from its full-time clinical teachers, especially when compared with the cost of the staff to the institution. At one institution, the income from fees accruing to the benefit of the school from four full-time departments averaged $13,000, in another something over $8,000, in a third slightly over $9,000 a year. Two things are clear: that the schools are not exploiting their full-time clinical staffs, and that the staffs at this time find relatively little in consulting practice that humanly, educationally, or scientifically requires their particular attention.

A question has been raised as to whether by an adaptation of German practice in respect to student fees an academic organization approximating the full-time system cannot be effected by institutions whose resources are limited. It has, for example, been suggested that in the institutions in question the clinical staff be salaried on the same basis as the instructional staff in other departments, and that medical and surgical fees, received from the relatively small number of private cases to be admitted to the university hospital (other forms of practice would be excluded) be divided between university and clinician on something like the basis that prior to the war prevailed in German universities in respect to student fees. Thus, the professor would receive an increment, which would, however, terminate altogether when his total income reached the level now

in charge of patients may have to be a more mature and experienced person than an associate professor of a pre-clinical science. It is, however, a point that will bear watching.

prevailing in the full-time departments of endowed schools. The objections lie on the surface, for it makes the members of the full-time clinical staff earn their way between the level of the instructional salary and the level at which their participation in fees ceases. It will be remembered that, though competition for students stimulates the German professor to teach well and to keep to his productive work, it has also its shady side. In the present instance, up to the agreed level, the stimulus would not be either scientific or educational. That level once reached, however, incentive to earn ceases, and the staff is free to teach and investigate. Whether the scheme is really workable, and whether, if so, its benefits would outweigh the objections, near and remote, experience alone can decide. In any event, it is no substitute for the really rigid full-time organization at the present stage of medical development.[29]

The general position is in any case clear: the clinical sciences cannot be prosecuted in the spirit of the university unless clinical teachers practically identify themselves in respect to income and scale of living with the university rather than with the medical profession. This status has been frankly and finely accepted in some countries. In the smaller European states—Sweden, Denmark, and Switzerland, for example—and in the smaller German universities, status and tradition have on the whole worked effectively; professional work has been restricted and has even been utilized to subsidize research. In the great

[29] As this book passes through the press, a university is undertaking to organize a department of medicine in the following manner: the department is to have a total budget of approximately $35,000, which will provide several full-time juniors and a salary of $10,000 for the head: of the latter sum the university obligates itself to pay $7,500; the professor may have fees from consultations not to exceed $2,500; if said fees fail to amount to $2,500, the university will make good the deficit; any sum over $2,500 goes to the medical school. The university thus limits practice and income, in order to procure time for teaching and research and to avoid friction with the local profession. Were funds available, rigid full time would be instituted. These variations are interesting, not as substitutes for full time, but as showing how institutions with limited resources are endeavoring, as nearly as they can, to attain its spirit and opportunities.

cities of the continent, the situation is less satisfactory; it is, however, most difficult in America for the reason already adverted to, viz., the lack of an organized academic status. Especially in large cities, young scientists are fair prey for competing hostesses. The simple life, on which basis alone universities have thus far been elsewhere successful, is difficult and rare in the great American cities. It remains to be seen whether medicine can be generally converted into a university discipline, or whether proximity to a prosperous practising profession will result in professional rather than academic standards of living.

In this connection, the experience of law schools is not unilluminating. On paper, practically all the forty-eight law schools forming the Association of American Law Schools "are on an academic basis. In fact, probably less than half a dozen find their teaching staff exclusively devoted to law school work." [30] The others, lacking a definite contractual arrangement or its equivalent, have in varying degrees drifted into consultative practice, more or less inimical to sole devotion to education and research. At Harvard, the full-time teacher of law receives a strictly academic salary, far, very far, below his possible earnings in practice; and the university makes no such provision for legal research as it makes for his medical colleague. Perhaps residence in Cambridge as against residence in Boston or New York simplifies his problem, for certainly the legal profession is not simpler than the medical in the scale of living of its prominent members. It is at any rate curious that eminent legal scholars welcome the academic basis somewhat more readily than surgeons, and not without significance that, barring a definite provision, practice often insidiously invades.[31]

The final word on the subject may, however, fairly strike a hopeful note. Financial hardship has nowhere in Europe destroyed the worker's interest in medical science; England,

[30] Quotation from private letter.

[31] On the other hand, the plan has been in vogue longer.

with modest means, has put to work more investigators than at any time in its history. Our own resources, heavily taxed in comparison with a previous era, are far from exhausted. A good case must indeed be made out for every further step. But, on the other hand, excessive caution may defeat its own purpose. Research involves risk and waste. If only a small proportion of investigations bear fruit, the harvest will richly repay. Every laboratory of science must enjoy a margin of time, money, and energy sufficient to encourage and sustain effort in the field of ideas. In general, the forward movement in the financing of medical education and research during recent years is to be regarded as a triumph and an inspiration.

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